September 2014 Update: EPA has validated and published a rapid method for building material matrices for analysis of radium-226. The method is summarized and accessible through the link provided below.

Rapid Radiochemical Method for Radium-226 in Building Materials for Environmental Remediation Following Radiological Incidents

Analyte(s)	CAS RN
Radium-226	13982-63-3

Analysis Purpose: Qualitative analysis
Technique: Alpha spectrometry

Method Developed for: Radium-226 in building materials
Method Selected for: SAM lists this method for qualitative analysis of radium-226 in concrete or brick building materials

Description of Method: A known quantity of radium-225 is used as the yield tracer in this analysis. The sample is fused using the procedure described in "Rapid Method for Sodium Hydroxide Fusion of Concrete and Brick Matrices Prior to Americium, Plutonium, Strontium, Radium, and Uranium Analyses," Revision 0, EPA 402-R14-004 (Reference 16.3 of the method), and then the radium isotopes are removed from the fusion matrix using a carbonate precipitation step. The sample is acidified and loaded onto 50WX8 cation exchange resin to remove sample interferences such as calcium. The radium is eluted from the cation resin with 8M nitric acid. After evaporation of the eluate, the sample is dissolved in a minimal amount of 3M nitric acid and passed through Sr Resin to remove any barium present. This solution is then evaporated to dryness, redissolved in 0.02M hydrochloric acid, and passed through Ln Resin to remove interferences such as residual calcium, and to remove the initial actinium-225 present. The radium (including radium-226) is prepared for counting by microprecipitation with barium sulfate. The activity measured in the radium-226 region of interest is corrected for chemical yield based on the observed activity of the alpha peak at 7.07 MeV (astatine-217, the third progeny of radium-225).

This method is suited for low-level measurements for radium-226 using alpha spectrometry and is capable of satisfying a method uncertainty of 0.83 pCi/g at an analytical action level of 6.41 pCi/g. To attain the stated measurement quality objectives (MQOs), a sample aliquant of approximately 1 g and count time of 8 hours (or longer) are recommended.

Special Considerations: Depending on actual spectral resolution, method performance may be compromised if samples contain high levels of other radium isotopes (e.g., ~3 times the radium-226 activity concentration) due to ingrowth of interfering decay progeny. Calcium, iron (+3 oxidation state), and radionuclides with overlapping alpha energies, such as thorium-229, uranium-234, and neptunium-237, will interfere if they are not removed effectively. Delaying the count significantly longer than a day may introduce a possible positive bias in results near the detection threshold due to the decay progeny from the radium 225 tracer. If radium-226 measurements close to detection levels are required and sample counting cannot be performed within ~36 hours of tracer addition, the impact of tracer progeny tailing into the radium-226 may be minimized by reducing the amount of the tracer that is added to the sample. This will aid in improving the signal-to-noise ratio for the radium-226 peak by minimizing the amount of tailing from higher energy alphas of the radium-225 progeny. If actinium-225 is present prior to the final separation time and the flow rate through the column is too fast (>1.5 drops/second), then actinium-225 will break through the resin, resulting in a high bias in the tracer yield. Additional information regarding procedures to remove or minimize interferences is provided in Section 4 of the method.

Source: U.S. EPA, National Air and Radiation Environmental Laboratory (NAREL). April 2014. Rev 0 "Rapid Radiochemical Method for Radium-226 in Building Materials for Environmental Remediation Following Radiological Incidents," EPA 402-R14-002.
http://www2.epa.gov/radiation/rapid-radiochemical-methods-selected-radionuclides