September 2013 Update: EPA has validated and published a rapid method for sodium carbonate fusion of soil matrices for analysis of strontium-90. The method is summarized and accessible through the link provided below, and replaces use of the Department of Energy's "Actinide and Sr-89/90 in Soil Samples" for analysis of americium-241, plutonium-238, plutonium-239, uranium-234, uranium-235, and uranium-238 in soil when using the methods listed in SAM.

Rapid Method for Fusion of Soil and Soil-Related Matrices Prior to Americium, Plutonium, and Uranium Analyses for Environmental Remediation Following Radiological Incidents

Analyte(s)	CAS RN
Americium-241	14596-10-2
Plutonium-238	13981-16-3
Plutonium-239	15117-48-3
Uranium-234	13966-29-5
Uranium-235	15117-96-1
Uranium-238	7440-61-1

Analysis Purpose: Qualitative analysis
Technique: Alpha spectrometry

Method Developed for: Americium-241, Plutonium-238, Plutonium-239, Uranium-234, Uranium-235, and Uranium-238 in soil samples
Method Selected for: SAM lists this method for qualitative analysis of soil/sediment samples

Description of Method: The method is based on the complete fusion of a representative, finely ground 1-g aliquot of dried sample with no insoluble residue remaining after dissolution of the fused melt in acid. For organic soil matrices, the sample is dry-ashed at 600 ^{o}C in an appropriate vessel prior to fusion. The sample is dissolved in a crucible with hydrofluoric acid and evaporated to dryness on a hotplate at medium to high heat (~300 ^{o}C). Dry flux mix (equal weight of dried sodium carbonate, potassium carbonate and boric acid) is added and the crucible is warmed under a flame until a reaction initiates. The crucible is then heated under full flame until the reaction subsides and the melt is completely liquid and homogeneous. After cooling, the solidified melt is dissolved in nitric acid. If necessary, any boric acid that may have precipitated during cooling is vacuum filtered. The dissolved sample is transferred to an appropriately sized beaker, and the crucible is rinsed with nitric acid to ensure a quantitative transfer of material. The sample is then processed using one of the following methods:

Rapid Radiochemical Method for Americium-241 in Water
Rapid Radiochemical Method for Plutonium-238 and Plutonium-239/240 in Water
Rapid Radiochemical Method for Isotopic Uranium in Water

Special Considerations: If the sample may contain discrete radioactive particles (DRPs) or particles larger than a nominal size of 150 µm, additional sample preparation may be necessary as described in Sections A4 and A5.2.3 of the method (Interferences and Hot Particles, respectively). Soils with high silica content may require either additional fusing reagent and boric acid or a longer fusion melt. Platinum crucibles must be used, in this method, when digesting samples with hydrofluoric acid. If platinum crucibles are not available, an effective, alternate method is available that uses zirconium crucibles [see *Rapid Method for Sodium Hydroxide Fusion of Concrete Matrices prior to Am, Pu, Sr, Ra, and U Analyses* (www2.epa.gov/radiation/incident-guides) and *Rapid Radiochemical Method for Total*

Radiostrontium (Sr-90) in Building Materials for Environmental Remediation Following Radiological Incidents (www2.epa.gov/radiation/incident-guides)].

Source: EPA, National Air and Radiation Environmental Laboratory (NAREL). August 2012. Rev 0 "Rapid Method for Fusion of Soil and Soil-Related Matrices Prior to Americium, Plutonium, and Uranium Analyses for Environmental Remediation Following Radiological Incidents," EPA-600-R-12-636+637+638. http://www2.epa.gov/radiation/rapid-radiochemical-methods-selected-radionuclides