Pu Measurements by Accelerator Mass Spectrometry at LLNL

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We have developed an accelerator mass spectrometry (AMS) capability at Lawrence Livermore National Laboratory's Center for Accelerator Mass Spectrometry for the measurement of plutonium concentrations and isotopic ratios in environmental samples, including soils, sediments, waters, tissue samples, and human urine. The high rejection of interferences, including molecular interferences, and the low susceptibility to matrix components provided by AMS reduce the demands on the sample preparation chemistry for Pu analyses. When combined with the high sample throughput capabilities of our AMS system, the result is a rapid and cost-effective measurement technique.

We will report on the status of recent technical developments of our AMS system. With the installation of a 4.4 m radius 45° cylindrical electrostatic analyzer (ESA), the second phase of the development of the high-energy spectrometer, which is capable of transporting and analyzing high-mass isotopes, has been completed. In addition, we have installed a fast isotope switching capability, which allows flexibility in isotope selection and for the quasi-continuous normalization to a reference isotope spike, such as ^{242}Pu in bioassay measurements. Current background levels equivalent to $<10^6$ atoms are observed during routine ^{239}Pu measurements. Measurements of samples containing 10^{13} ^{238}U atoms indicate that the total rejection of that isotope provided by our AMS system is at least $\sim 10^7$. The high dynamic range of the AMS system has allowed the measurement of samples over the range from $<10^6$ (background) to $>10^{11}$ Pu atoms.

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