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USE OF PLASMA-SOURCE MULTICOLLECTOR MAGNETIC-SECTOR MASS SPECTROMETRY FOR URANIUM AND PLUTONIUM ANALYSIS IN ENVIRONMENTAL SAMPLES

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The ability to detect and isotopically characterize uranium and plutonium in environmental samples is of primary importance in the search for nuclear proliferation. The utility of isotope ratio measurements for environmental monitoring is limited by sample preparation costs, measurement precision, and sensitivity. This is particularly true for wide-area monitoring where the number of samples required varies inversely with obtainable precision and sensitivity. Historically isotopic measurements have been made by thermal ionization mass spectrometry (TIMS). While requiring extensive sample preparation, no other technique matched its precision and sensitivity for such measurements.

Inductively-coupled-plasma, magnetic-sector, multicollector, mass spectrometry offers the prospect of extending the state-of-the-art to higher precision while increasing sensitivity and reducing costs through more rapid analysis and reduced sample preparation. At LLNL this technique is being implemented in the form of an IsoProbe (Micromass, UK). This paper will present data for both standards and IAEA supplied samples demonstrating the power and limitations of the technique. The precision and sensitivity of the IsoProbe results will be compared to TIMS performance for comparable samples. For 48 determinations of natural uranium, using the double spike to correct for bias, a relative standard deviation of 0.04% (1σ) for $^{238}U/^{235}U$ has been obtained in a preliminary study. This is a substantial improvement over the TIMS result of 0.1% reported at the previous conference. Further improvements can be expected as we gain a better understanding of the background peaks occurring in the IsoProbe spectra.