



New Brunswick Laboratory
U.S. Department of Energy

Certificate of Analysis
CRM U930-D
Uranium Isotopic Standard

	²³⁴ U	²³⁵ U	²³⁸ U	²³⁴ U/ ²³⁵ U	²³⁸ U/ ²³⁵ U
Atom Percent:	1.0291	93.2702	5.7007	0.011034	0.061120
Expanded Uncertainty:	0.0017	0.0049	0.0052	0.000018	0.000059
Mass Percent:	1.0241	93.2063	5.7696		

Relative Atomic Mass: 235.20501 ± 0.00016

This Certified Reference Material (CRM) is primarily intended for use as an isotopic standard in the mass spectrometric analysis of uranium. Each unit of CRM U930-D contains approximately 5.4 grams of a uranium solution packaged in a sealed 5-mL borosilicate glass ampule. The solution was prepared by dissolving uranium nitrate hexahydrate in a 0.8 mol/L solution of twice-distilled nitric acid. The elemental uranium concentration is approximately 1 milligram of uranium per gram of solution. This concentration is suitable for loading filaments for thermal ionization mass spectrometry.

The uranium isotopic ratio measurements were performed by two analysts each using a different thermal ionization mass spectrometer. Mass discrimination correction factors applied to measured CRM U930-D isotopic ratios were determined from multiple analyses of NBL CRM U930 run sequentially with CRM U930-D. The presence of trace ²³³U and ²³⁶U isotopic abundances was evaluated using a secondary electron multiplier detector. No measurable ²³³U was detected. A small quantity of ²³⁶U was detected and the atomic abundance is estimated, but not certified, to be less than 1 part per 10⁶. The isotopic measurements were performed during August and September, 1995.

The expanded uncertainty (U) for a certified property of CRM U930-D is defined as an interval around the value of the property; this is obtained by multiplying the combined standard uncertainty (u_c) by a coverage factor (k). The coverage factor, k is the Student's t factor based on the effective degrees of freedom to provide a 95% level of confidence. The combined standard uncertainty consists of Type A components derived from statistically evaluated standard deviations associated with isotopic ratio measurements, sample preparation, and instrument performance, and a Type B component which is based on the standard uncertainties taken from the CRM U930 certified values.

CRM U930-D solution was prepared by P.M. Santoliquido and packaged by P.M. Santoliquido, P.V. Croatto and P.B. Mason. Health physics support was provided by R.A. Mason and F.P. Orlowicz. Titrimetric assay measurements to verify prepared elemental solution concentration were performed by I.W. Frank. Isotopic ratio measurements were performed by A.J. Traina, Jr. and F.E. Jones; assessment of isotope data was provided by S.A. Goldberg. Statistical plan of analysis was prepared by M.M. Smith; assessment of the data for certification was performed by M.M. Smith, M.D. Soriano and D.T. Baran. Technical guidance for the preparation, certification and issuance of NBL CRM U930-D was provided by U.I. Narayanan and C.G. Gradle. Project supervision was provided by R.D. Oldham and W.G. Mitchell.

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www.nbl.doe.gov
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Jon Neuhoff, Director
New Brunswick Laboratory

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