# NBL Program Office

*U.S. Department of Energy*

# Certificate of Analysis

## Certified Reference Material CRM U930D (5mg) Uranium Isotopic Solution, 93% U-235, 5 mg U

| | $^{234}U$ | $^{235}U$ | $^{238}U$ | $^{234}U/^{235}U$ | $^{238}U/^{235}U$ |
|---|---|---|---|---|---|
| **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 U930D 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 U930D isotopic ratios were determined from multiple analyses of NBL CRM U930 run sequentially with CRM U930D. The presence of trace $^{233}U$ and $^{236}U$ isotopic abundances was evaluated using a secondary electron multiplier detector. No measurable $^{233}U$ was detected. A small quantity of $^{236}U$ was detected and the atomic abundance is estimated, but not certified, to be less than 1 part per $10^6$. The isotopic measurements were performed during August and September, 1995.

The expanded uncertainty (U) for a certified property of CRM U930D 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.

**Expiration of Certificate:** When stored in its original, unopened container, the certification of this material is valid indefinitely. The NBL PO will periodically monitor the materials in inventory and notify customers should degradation be detected.

**Stability and Storage:** This material should be stored in its original packaging under normal laboratory environmental conditions.

**Minimum Sample Size:** The material is considered a pure solution, and thus no minimum sample size is declared.