National Nuclear Security Administration

Nuclear Reference Material Program

U.S. Department of Energy

Certificate of Analysis

Certified Reference Material U930D (5 mg)

Uranyl Nitrate Isotopic Standard, 93 % U-235

5 mg in Solution Form

Description: Each unit of Certified Reference Material (CRM) U930D contains approximately 5 mg of uranium in 5.4 g of 0.8 mol L^{-1} nitric acid packaged in a sealed 5 mL borosilicate glass ampule. Certified isotope composition values are reported in Table 1.

Table 1. Certified Property Values and Uncertainties [(a)]

	$n(^{234}U)/n(^{235}U)$	$n(^{238}U)/n(^{235}U)$		**g mol^{-1}**
Isotope-Amount Ratio:	0.011034	0.061120	Uranium Molar Mass:	235.20501
Uncertainty:	0.000018	0.000059	Uncertainty:	0.00016
Isotope-Amount Fraction (•100):	$n(^{234}U)/n(U)$ 1.0291	$n(^{235}U)/n(U)$ 93.2702	$n(^{238}U)/n(U)$ 5.7007	
Uncertainty:	0.0017	0.0049	0.0052	
Isotope-Mass Fraction (•100):	$m(^{234}U)/m(U)$ 1.0241	$m(^{235}U)/m(U)$ 93.2063	$m(^{238}U)/m(U)$ 5.7696	
Uncertainty:	0.0017	0.0049	0.0052	

[(a)] 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 evaluated components derived from standard deviations associated with isotopic ratio measurements, sample preparation, and instrument performance, and a Type B evaluated component based on the standard uncertainties taken from CRM U930 certified values.

Intended use: CRM U930D is intended primarily for use as an isotopic standard in mass spectrometric analysis of uranium.

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

Period of validity: When stored in its original, unopened container, the certification of this material is valid indefinitely. The Nuclear Reference Material Program (NRMP) will notify customers should any degradation be detected.

Minimum sample size: The material is considered a pure solution; thus, no minimum sample size is declared.

Instructions for handling: The ampoule should be handled under proper radiologically-controlled conditions at all times. Care should be taken when scoring and breaking the ampoule to avoid injury and possible contamination. The material in the CRM U930 is radioactive. This radioactive material should be handled only by qualified individuals. To minimize personnel exposure, appropriate facilities and personal protective equipment should be used. Refer to the Safety Data Sheet for further information.

(Revision of Certificate Dated November 2020)
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January 2026

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Traceability statement: The isotope-amount ratios and isotope-amount fractions are traceable to the SI base unit of the mole. The isotope-mass fractions and the molar mass are traceable to the SI base units of the mole and the kilogram.

Additional information: The solution was prepared by dissolving uranium nitrate hexahydrate in a 0.8 mol L^{-1} solution of twice-distilled nitric acid. The uranium mass fraction is approximately 1 milligram of uranium per gram of solution. This mass fraction 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 CRM U930 measured 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.

In 2016 NBL transitioned to a program office within the Department of Energy and is now operating within the National Nuclear Security Administration (NNSA) as the Nuclear Reference Material Program (NRMP).