



*New Brunswick Laboratory*  
*U.S. Department of Energy*

## Certificate of Analysis

### CRM 125-A

## Uranium Oxide (UO<sub>2</sub>) Pellet Assay and Isotopic Standard

**Uranium Assay:** **88.129 ± 0.014 Wt %**  
**(0.88129 ± 0.00014 g U/g pellet)**

	<sup>234</sup> U	<sup>235</sup> U	<sup>236</sup> U	<sup>238</sup> U
<b>Atom Percent:</b>	<b>0.0374</b>	<b>4.0574</b>	<b>0.0003</b>	<b>95.9049</b>
<b>Uncertainty:</b>	<b>0.0003</b>	<b>0.0028</b>	<b>0.0002</b>	<b>0.0029</b>
<b>Mass Percent:</b>	<b>0.0368</b>	<b>4.0082</b>	<b>0.0003</b>	<b>95.9547</b>
<b>Uncertainty:</b>	<b>0.0003</b>	<b>0.0029</b>	<b>0.0002</b>	<b>0.0028</b>

**Relative Atomic Mass:** **237.92727 ± 0.00008**

**Each uncertainty is expressed as the expanded uncertainty at the 95% level of confidence.**

This Certified Reference Material (CRM) is an assay and isotopic standard primarily for use in the analysis of uranium in fabricated fuel form. Each unit of CRM 125-A consists of one enriched uranium dioxide (UO<sub>2</sub>) pellet, weighing approximately 5.4 grams, contained in a snap-cap glass vial.

NOTE: *The vial should be handled under proper radiologically-controlled conditions at all times.*

The material used for CRM 125-A was a single production batch of pellets prepared by Westinghouse Commercial Nuclear Fuels Division (CNFD), Columbia, South Carolina. The uranium assay was determined by the NBL high precision titrimetric method using NBL CRM 99, Potassium Dichromate Oxidimetric Standard, as the titrant. NBL CRM 112-A, Uranium Metal Assay Standard, was used as a control to verify proper performance of the measurement systems. In addition, gravimetric analyses were performed to verify that pellet-to-pellet inhomogeneity is negligible. The uranium isotopic composition was determined by thermal ionization mass spectrometry. Mass discrimination corrections were established from measurements of <sup>235</sup>U/<sup>238</sup>U ratios in samples of NBS SRM U-030 and NBL CRM U050, Uranium Isotopic Standards, with reference to certified values. Measurements of NBL CRM U500, Uranium Isotopic Standard, were used as controls to verify proper performance of the measurement system. The total metal impurity content is estimated to be less than 80 µg/g sample, as determined by optical emission spectrometry. The impurity content is provided for information only and is not certified.

NOTE: *If this material is analyzed by gravimetry, it is the responsibility of the user to determine and subtract impurities as necessary.*

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The expanded uncertainty (U) for a certified property of CRM 125-A is defined as an interval around the value of the property; this interval has a 95% level of confidence and 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 for uranium assay consists of Type A components derived from standard deviations associated with titration measurements and weighings of solid dichromate titrant (NBL CRM 99) and sample pellets, and a Type B component which is based on the standard uncertainty taken from the NBL CRM 99 certified value. The combined standard uncertainties for uranium isotopic abundances consist of Type A components derived from standard deviations associated with isotopic ratio measurements, and Type B components which are based on the standard uncertainties taken from the NBS SRM U-030 and NBL CRM U050 certified values.

Technical coordination for the preparation, certification, and issuance of NBL CRM 125-A was provided by M.I. Spaletto and C.G. Gradle. Analytical samples were prepared by A.V. Stiffin. Titrimetric assay measurements were performed by A.M. Voeks and W. Nichiporuk, and gravimetric analyses were performed by K.S. Scheidelman. Isotopic abundance measurements were performed by F.E. Jones; assessment of isotopic data was provided by S. A. Goldberg. Health physics support was provided by R.A. Mason. Impurity measurements were performed by Westinghouse CNFD. The statistical plan of analysis was prepared by M.D. Soriano, and assessment of the data for certification was performed by M.D. Soriano and D.T. Baran. Technical guidance was provided by U.I. Narayanan and C.G. Gradle. Project supervision was provided by R.D. Oldharn and W.G. Mitchell.