



Certificate of Analysis
Certified Reference Material C111 (5mg)
Uranium (U-233) Spike Assay and Isotopic Solution
Standard

Uranium Concentration.....	2.1023 ± 0.0011	µmoles/gram
Uranium-233	99.9245	± 0.0006 At. %
Uranium-234	0.0181	± 0.0002 At. %
Uranium-235	0.0011	± 0.0002 At. %
Uranium-238	0.0563	± 0.0004 At. %

This Certified Reference Material (CRM) is an assay and isotopic standard for use as a spike in the analysis of uranium materials by isotope dilution mass spectrometry (IDMS). Each unit of C111 contains approximately 5 milligrams of uranium, dissolved in 0.8 N HNO₃, sealed in a glass ampoule.

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

The indicated uncertainty for the concentration is the tolerance limit for at least 99% coverage with a probability level of 0.95. In brief, at least 99% of the measured values on all ampoules should fall within the indicated interval with a probability of 0.95. This statistical approach is necessary due to the concentration variability between ampoules. (See page 14 of "The Role of Standard Reference Materials in Measurement Systems," NBS Monograph 148, 1975, for a more detailed explanation of the tolerance limit concept.) Since isotopic composition shows little variability between ampoules, the indicated uncertainties for the isotopic composition are 95% confidence limits for the mean.

This CRM was originally issued in 1980 by the National Bureau of Standards (NBS) as Standard Reference Material (SRM) 995. The measurements made at NBS leading to the certification were performed by J.D. Fassett, J.W. Gramlich, and L.A. Machlan, under the direction of E.L. Garner. In 1987, the technical and administrative transfer of NBS Special Nuclear SRMs into the NBL CRM Program was coordinated by the NBS Office of Standard Reference Materials and N.M. Trahey, NBL.

The uranium concentration of this CRM was determined by IDMS using high-purity spikes prepared from CRM 135, ^{235}U spike (formerly SRM 993) and CRM 112A, ^{238}U Metal Assay Standard (formerly SRM 960). Analyses were made on a solid-sample thermal ionization mass spectrometer. Corrections for mass discrimination effects were based upon analyses of CRM U500 (formerly SRM U-500).

The ^{233}U to ^{238}U measurement was made using a solid-sample thermal ionization mass spectrometer equipped with a Faraday cup detection system.

The ^{234}U and ^{235}U abundances were measured with respect to ^{238}U in the material using a thermal ionization mass spectrometer equipped with a pulse-counting detection system.

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.

NOTE: NBS Special Publication 260-27 presents further details of the measurements made at NBS which provided the basis for the certification, and is available from the NBS Office of Standard Reference Materials upon request.