

# National Bureau of Standards

## Certificate of Analysis

### Standard Reference Material U-200

#### Uranium Isotopic Standard

#### (Nominally 20% Enriched)

	$^{234}\text{U}$	$^{235}\text{U}$	$^{236}\text{U}$	$^{238}\text{U}$
Atom Percent	0.1246	20.013	0.2116	79.651
	$\pm 0.0003$	$\pm 0.020$	$\pm 0.0006$	$\pm 0.021$
Weight Percent	.1229	19.811	.2103	79.856

This Standard Reference Material (SRM) is certified for use as an isotopic standard. The primary intended use is for the evaluation of mass discrimination effects encountered in the operation of a mass spectrometer.

The material consists of highly purified uranium oxide,  $\text{U}_3\text{O}_8$ . The atomic weight of the material is calculated to be 237.440, using the nuclidic masses 234.0409; 235.0439; 236.0457; and 238.0508.

The values for  $^{234}\text{U}$  and  $^{236}\text{U}$  were calculated from measurements at the National Bureau of Standards. The samples were spiked with high-purity  $^{233}\text{U}$  to approximate the  $^{234}\text{U}$  concentration, the ratios  $^{233}\text{U}$  to  $^{234}\text{U}$  and  $^{233}\text{U}$  to  $^{236}\text{U}$  were measured on a triple-filament equipped surface ionization mass spectrometer with d-c amplifier circuits.

The values for  $^{235}\text{U}$  and  $^{238}\text{U}$  were calculated from measurements made at the National Bureau of Standards, at Union Carbide Nuclear Co., Oak Ridge, Tenn., and at Goodyear Atomic Corp., Portsmouth, Ohio, each laboratory's value being given equal weight. Values obtained at NBS are the result of direct measurement of the  $^{235}\text{U}$  to  $^{238}\text{U}$  ratio using triple-filament thermal ionization. The observed ratios were corrected for mass discrimination effects by determining the system bias from measurements on standards U-500 and U-100. Experience at NBS has shown, through intercomparison of the standards, and synthetic mixtures at the 10-, 50-, and 90-percent  $^{235}\text{U}$  level prepared from high-purity  $^{235}\text{U}$  and  $^{238}\text{U}$  isotopes, that a constant bias for a given procedure can be maintained over the range of 5- to 95-percent  $^{235}\text{U}$ . Values from Union Carbide and Goodyear Atomic are based on direct determinations of the  $^{235}\text{U}$  concentration by oxide dilution and  $\text{UF}_6$  analysis, and then the ratio calculated using the NBS values for  $^{234}\text{U}$  and  $^{236}\text{U}$ , and the  $^{238}\text{U}$  value obtained by difference.

The indicated uncertainties for the isotopic concentrations are at the 95-percent confidence level for a single determination. The  $^{235}\text{U}$  to  $^{238}\text{U}$  ratio for this standard, 0.25126, is known to at least 0.1 percent; at the same time the pooled variance for the calibration system is significantly smaller.

Measurements leading to the certification of this SRM were made by E. L. Garner, L. A. Machlan, M. S. Richmond, and W. R. Shields.

The technical and support aspects in the preparation, certification, and issuance of this Standard Reference Material were coordinated through the Office of Standard Reference Materials by J. L. Hague.

NOTE: In many industries traceability of their quality control process to the national measurement system is carried out through the mechanisms of SRM's. It may be therefore of interest to know the details of the measurements made at NBS in arriving at the certified values of this SRM. An NBS Special Publication, 260-27, is reserved for this purpose and is available from the NBS Office of Standard Reference Materials upon request.