



**NBL Program Office**  
*U.S. Department of Energy*



**Certificate of Analysis**  
**Certified Reference Material C138 (250mg)**  
**Plutonium Isotopic Standard**

	<sup>238</sup> Pu	<sup>239</sup> Pu	<sup>240</sup> Pu	<sup>241</sup> Pu	<sup>242</sup> Pu
Atom Percent:*	0.010 ±0.001	91.805 ±0.010	7.925 ±0.010	0.227 ±0.001	0.0330 ±0.0003
Weight Percent:*	0.010	91.772	7.955	0.229	0.0334

\*As of October 1, 1987.

This Certified Reference Material (CRM) is primarily intended for use as an isotopic standard in the mass spectrometric analysis of plutonium. Each unit of C138 consists of about 0.25 grams of plutonium, in the form of plutonium sulfate tetrahydrate, contained in a glass microbottle. NOTE: *The microbottle and its containment should be handled under proper radiologically-controlled conditions at all times.*

The indicated uncertainties for the isotopic composition of the CRM are 95% confidence intervals for a single determination. This term can be defined as an approximate two-sigma limit, where sigma is the standard deviation of the measurements data obtained from the material.

This CRM was originally issued in 1970 by the National Bureau of Standards (NBS) as Standard Reference Material (SRM) 948. The measurements made at NBS leading to the certification were performed by E. L. Garner and L. A. Machlan. 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 certified isotopic abundance values were determined using solid-sample thermal ionization mass spectrometry. These analyses were corrected for mass discrimination effects relative to uranium isotopic CRMs (issued by NBS as SRMs), since high-purity plutonium separated isotopes were not available for the preparation of synthetic calibration mixtures.

Chemical separation of the plutonium from its uranium and americium daughters prior to use is essential for high accuracy, since these daughters contain isotopes which are isobaric with plutonium isotopes.

The half-life values (in years) used for the decay calculations are as follows: <sup>238</sup>Pu - 87.74; <sup>239</sup>Pu - 24,119; <sup>240</sup>Pu - 6,562; <sup>241</sup>Pu - 14.35; and <sup>242</sup>Pu - 376,300.