. S. Department of Commerce
Philip M. Klutznick
Secretary
National Bureau of Standards
Ernest Ambler, Director

National Bureau of Standards Certificate

Standard Reference Material 4338

Alpha-Particle Emission-Rate Solution Standard

Plutonium-240

This Standard Reference Material consists of plutonium-240 in 5.0 grams of 5 M HCl in a flame-sealed borosilicate-glass ampoule.

The alpha-particle-emission rate per gram of solution of plutonium-240 together with that of the other alpha-particle-emitting impurities listed below, at 1200 EST April 22, 1980, was

$$*17.76 \ \alpha s^{-1} g^{-1} \pm 1.0\%*.$$

This Standard Reference Material was calibrated by means of (1) alpha-particle counting of quantitatively prepared, evaporated point sources using the NBS $0.1\pi\alpha$ counter and (2) alpha-particle counting of quantitatively prepared solution sources using the NBS $4\pi\alpha$ liquid-scintillation (LS) system. The alpha-particle-emission rate per gram of solution was calculated as the unweighted mean of nine independent determinations (five using the $0.1\pi\alpha$ counter and four using the $4\pi\alpha$ (LS) system).

The uncertainty in the alpha-particle-emission rate per gram of solution, 1.0 percent, is the linear sum of 0.37 percent, which is half the 99-percent confidence interval of the unweighted mean (3.355 times the standard error computed from nine independent determinations), and 0.63 percent, which is the sum of the estimated upper limits of conceivable systematic errors. The estimated upper limits of the individual systematic errors, which are comparable for both the $0.1\pi\alpha$ counter and the $4\pi\alpha$ (LS) system, are:

Sample preparation	0.20%
Background subtraction	0.11%
Spectrum extrapolation to zero pulse height	0.07%
Livetime	0.10%
Counter geometry and detection efficiency	0.15%
	0.63%

Information from the supplier concerning the isotopic composition of the starting material is given in the attached table.

This Standard Reference Material was prepared in the Center for Radiation Research, Nuclear Radiation Division, Radioactivity Group, W.B. Mann, Principal Scientist.

Washington, D.C. 20234
August, 1980

George A. Uriano, Chief
Office of Standard Reference Materials

SRM 4338

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Isotopic Composition of Plutonium-240
Standard Reference Material 4338

Isotope	Mass fraction on July 24, 1979[a]	Half life (years)[b]	Approximate relative α-particle-emission rate on April 22, 1980[c]
^{238}Pu	0.00014	87.74	1.0×10^{-2}
^{239}Pu	0.00023	24119	6.2×10^{-5}
^{240}Pu	0.99930	6537	1.000
^{241}Pu	0.00003	14.35	3×10^{-7} (plus 1×10^{-2} β)
^{242}Pu	0.00029	3.79×10^{5}	5.0×10^{-6}
^{244}Pu	0.00001	8.26×10^{7}	8×10^{-10}

a) Date of purification; assay by mass spectrometry.

b) The half lives used are taken from appendix B, American National Standard Calibration Techniques for the Calorimetric Assay of Plutonium-Bearing Solids Applied to Nuclear Materials Control, N15.22 - 1975, except for the half lives of plutonium-238 and plutonium-239, which are from W.W. Strohm, Int. J. Appl. Radiat. Isotopes 29, 481 (1978), and the half life of plutonium-244, which is from M.R. Schmorak, Nucl. Data Sheets 17, 405 (1976).

c) Date of calibration.