

National Bureau of Standards

Standard Reference Material 4216

Mixed Radionuclide Gamma-Ray Emission-Rate Point-Source Standard

This standard consists of cobalt-57, cobalt-60, strontium-85, yttrium-88, cadmium-109, tin-113-indium-113m, cesium-137-barium-137m, cerium-139, and mercury-203, deposited as the chlorides and sulfides, on polyester tape approximately 0.006-centimeter thick and covered by another layer of the same tape.

The point source was prepared by depositing a weighed aliquot of a calibrated radionuclide mixture on the tape and exposing it to hydrogen sulfide gas to precipitate the mercuric sulfide.

The gamma-ray emission rates of the solutions used to prepare the radionuclide mixture were determined by means of the NBS calibrated "4 π "-ionization chamber, using, where necessary, assumed nuclear decay parameters.

The nuclear gamma-ray emission rates at 1200 EST June 1, 1973 are shown in the table below (reverse).

The uncertainty in the gamma-ray emission rate for each radionuclide is the linear sum of the 99% confidence limit of the ionization chamber measurement ($2.861 S_m$, where S_m is the standard error computed from 20 determinations) and the estimated upper limits of conceivable systematic errors.

The cobalt-57 contains cobalt-56 and cobalt-58 as impurities. The activity ratios, $^{56}\text{Co}/^{57}\text{Co}$ and $^{58}\text{Co}/^{57}\text{Co}$, were approximately 7.7×10^{-4} and 4.5×10^{-4} , respectively, at 1200 EST June 1, 1973. The cesium-137-barium-137m contains cesium-134 as an impurity. The activity ratio, $^{134}\text{Cs}/^{137}\text{Cs}$, was approximately 1.3×10^{-4} at 1200 EST June 1, 1973. The gamma-ray spectrum of each component was examined using a Ge(Li) detector and no other impurities were found.

This standard was prepared in the NBS Center for Radiation Research, Radioactivity Section, W. B. Mann, Chief.

Washington, D. C. 20234
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J. Paul Cali, Chief
Office of Standard Reference Materials

(over)

Radionuclide	γ-Ray Energy (MeV) ^a	γ-Ray Intensity (%) ^a	Half-Life ^b	γ/s	Error %		
					Random	System	Total
¹⁰⁹ Cd	0.0877		1.2727y		0.1	2.7	2.8
⁵⁷ Co	0.122	85.6±0.2	271.41d		0.1	2.2	2.3
¹³⁹ Ce	0.166	79.9±0.3 ^b	137.87d		0.1	3.0	3.1
²⁰³ Hg	0.279	81.5±0.2	46.61d		0.1	1.1	1.2
¹¹³ Sn- ^{113m} In	0.392		115.31d		0.1	2.8	2.9
⁸⁵ Sr	0.514	99.28±0.01	64.86d		0.1	1.6	1.7
¹³⁷ Cs- ^{137m} Ba	0.662	85.0±0.3 ^c	30y		0.1	2.0	2.1
⁶⁰ Co	1.173	99.88±0.02	5.261y		0.1	1.3	1.4
	1.333	100			0.1	1.3	
⁸⁸ Y	0.898	93.4±0.7	106.63d		0.1	2.9	3.0
	1.836	99.37±0.02			0.1	2.2	2.3

^aNuclear Data Tables, A8, Nos. 1-2 (Oct. 1970).

^bNBS measured values.

^cThe latest recommended value for this intensity was obtained from Dr. Murray Martin, Oak Ridge National Laboratory.