

National Bureau of Standards Certificate

Standard Reference Material 4242-C

Mixed Radionuclide Gamma-Ray Emission-Rate Solution Standard

This Standard Reference Material 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 in grams of approximately 4N HCl in a flame-sealed borosilicate glass bottle of standard dimensions.

This standard was made by weighing an aliquot of a calibrated radionuclide mixture into the bottle containing the acid. The stable carrier concentration of each component in this calibrated mixture was adjusted such that the ratio of stable carrier atoms to radioactive atoms was greater than 10^4 .

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

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

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	2.8	2.9
⁵⁷ Co	0.122	85.6±0.2	271.41d		0.1	2.4	2.5
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	1.4	
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.

(over)

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 ($2.862 S_m$, where S_m is the standard error computed from 20 determinations) and the estimated upper limits of conceivable systematic errors.

The gamma-ray spectrum of each component was examined using a Ge(Li) detector. The cobalt-57 was found to contain 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 5.2×10^{-4} and 2.9×10^{-4} , respectively, at 1200 EST August 1, 1973. The cesium-137-barium-137m was found to contain cesium-134 as an impurity. The activity ratio $^{134}\text{Cs}/^{137}\text{Cs}$, was approximately 1.2×10^{-4} at 1200 EST August 1, 1973. No other impurities were found.

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

August 31, 1973
Washington, D. C. 20234 J. Paul Cali, Chief
Office of Standard Reference Materials

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