

National Bureau of Standards

Certificate

Standard Reference Material 4370C

Radioactivity Solution Standard

Radionuclide	Europium-152
Source identification	4370C
Source description	Liquid in 5-mL flame-sealed glass ampoule (1)*
Source mass	5.0338 ± 0.0019 grams (2)
Solution composition	277 ug Eu per gram of 1 M HCl
Radioactivity concentration	9.390×10^4 Bq g ⁻¹
Reference time	1200 EST February 2, 1987
Overall uncertainty	1.1 percent (3)
Photon-emitting impurities (activity ratio at reference time)	¹⁵⁴ Eu/ ¹⁵² Eu: $(2.9 \pm 0.3) \times 10^{-3}$ (4)
Half life	13.55 ± 0.06 years (5)
Measuring instrument	4π pressurized ionization-chamber "A" previously standardized by 4π counting with the NBS 8"x8" NaI(Tl) crystals

This Standard Reference Material was prepared in the Center for Radiation Research, Ionizing Radiation Division, Radioactivity Group, Dale D. Hoppes, Group Leader.

Gaithersburg, MD 20899
March, 1987

Stanley D. Rasberry, Chief
Office of Standard Reference Materials

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NOTES

- (1) Approximately five milliliters of solution. Ampoule specifications:

body diameter	16.5 ± 0.5 mm
wall thickness	0.60 ± 0.04 mm
barium content	less than 2.5 percent
lead oxide content	less than 0.02 percent
other heavy elements	trace quantities

- (2) The standard deviation is 0.0019 grams based on mass measurements of 15 ampoules.

- (3) The overall uncertainty was formed by taking three times the quadratic combination of standard deviations of the mean, or approximations thereof, for the following:

a) 1987 ionization-chamber measurements on 17 sources	0.02 percent
b) original ionization-chamber calibration using 7 sources	0.08 percent
c) ratio of radium reference sources	0.05 percent
d) solution attenuation of γ -rays	0.10 percent
e) gravimetric measurements	0.15 percent
f) impurities	0.10 percent
g) decay correction	0.02 percent
h) NaI(Tl) measurements on 6 sources	0.02 percent
i) NaI(Tl) detector efficiency	0.27 percent
j) fluorescence yield	<u>0.10 percent</u>
Combined	0.37 percent
	<u>× 3</u>
Overall	1.1 percent

- (4) The limit of detection, expressed as a percentage of the gamma-ray-emission rate of the 1408-keV gamma rays emitted in the decay of europium-152, is

0.1 percent between 90 and 1900 keV,

provided that the impurity photons are separated in energy by 5 keV or more from photons emitted in the decay of europium-152 and europium-154.

- (5) NBS-measured half-life value. NCRP Report No. 58, 2nd edition, 1985, p. 464 lists a value of 13.4 ± 0.1 years.

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