



National Institute of Standards & Technology

Certificate

Standard Reference Material 4408L-E Radioactivity Standard

Radionuclide	Cobalt-57
Source identification	4408L-E
Source description	Liquid in NIST borosilicate-glass ampoule ^{(1)*}
Solution composition	Approximately 103 micrograms of cobalt, as CoCl ₂ , per gram of 1 mol·L ⁻¹ hydrochloric acid ⁽²⁾
Mass	grams
Radioactivity concentration	1.594 x 10 ⁶ Bq·g ⁻¹
Reference time	0800 EST July 20, 1993
Overall uncertainty	0.86 percent ⁽³⁾
Photon-emitting impurities (Activity ratios at reference time)	⁵⁶ Co/ ⁵⁷ Co: (7.2 ± 0.7) x 10 ⁻⁴ ⁽⁴⁾ ⁵⁸ Co/ ⁵⁷ Co: (1.2 ± 0.1) x 10 ⁻⁴
Half life	271.7 ± 0.2 days ⁽⁵⁾
Measuring instrument	NIST pressurized "4π"γ ionization chamber calibrated by 4π(e,x)-γ coincidence efficiency-extrapolation technique

This Standard Reference Material was prepared in the Physics Laboratory, Ionizing Radiation Division, Radioactivity Group, J.M. Robin Hutchinson, Acting Group Leader.

Gaithersburg, MD 20899
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*Notes on back

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) Solution density 1.016 ± 0.002 g·mL⁻¹ at 22.9 °C.

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

a) six coincidence measurements	0.02 percent
b) gravimetric measurements on coincidence sources	0.10 percent
c) dead time	0.05 percent
d) resolving time	0.03 percent
e) background	0.07 percent
f) efficiency extrapolation	0.20 percent
g) half life during coincidence measurements	0.01 percent
h) impurities in coincidence sources	0.10 percent
i) ionization-chamber calibration measurements	0.01 percent
j) gravimetric measurements on ionization-chamber calibration ampoules	0.05 percent
k) half life during ionization-chamber calibration measurements	0.01 percent
l) twelve ionization-chamber measurements on this solution	0.01 percent
m) photon-emitting impurities in this solution	0.03 percent
n) radium-226 reference source positioning	0.10 percent
o) radium-226 half life	0.01 percent

- (4) Limits of detection as a percentage of the gamma-ray-emission rate of the 122.0614-keV gamma rays emitted in the decay of cobalt-57 are:

1 percent between 19 and 161 keV
0.02 percent between 171 and 3200 keV,

provided that the impurity photons are separated in energy by four keV or more from photons emitted in the decay of cobalt-57.

- (5) NCRP Report No. 58, 2nd edition, February 1985, p. 382-3.