

National Bureau of Standards

Certificate

Standard Reference Material 4219C

Radioactivity Standard

Radionuclide	Cadmium-109
Source identification	SRM 4219-C-
Source description	5 mL solution in NBS ampoule (1)*
Chemical composition	25 μg CdCl_2 per gram of 0.1 N hydrochloric acid
Mass	g
88-keV gamma-ray-emission rate	5988 $\gamma \text{ s}^{-1} \text{ g}^{-1}$ (2)
Reference time	1200 EST October 1, 1986
Overall uncertainty	1.4 percent (3)
Photon-emitting impurities	^{22}Na , ^{60}Co , ^{65}Zn (5)
Half life	462.6 \pm 0.4 days (6)
Measuring instrument	"4 π " γ NaI(Tl) crystal (7)

This Standard Reference Material was prepared in the NBS Center for Radiation Research, Ionizing Radiation Division, Radioactivity Group, D.D. Hoppes, Group Leader, with the assistance of Guest Scientist, C. Ballaux, of the Nuclear Chemistry Department, Studie Centrum voor Kernenergie, Mol, Belgium.

Gaithersburg, MD. 20899
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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 88-keV gamma-ray emission rate (N_γ) is the most useful parameter for this SRM, but measurements were also made of the source activity. The NBS measured activity concentration for this SRM was 1.623×10^5 Bq g⁻¹ on 1200 EST October 1, 1986. The overall uncertainty in the activity concentration is 1.5 percent⁽⁴⁾.

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

a) counting statistics	0.16 percent
b) gravimetric	0.10 percent
c) background	0.01 percent
d) adsorption	0.01 percent
e) impurities	0.01 percent
f) live-time correction	0.05 percent
g) extrapolation to 39.0 keV	0.07 percent
h) corrections for peak overlap	0.41 percent
i) detector dimensions	0.04 percent
j) source positioning	0.04 percent
k) energy calibration	<u>0.07 percent</u>
combined uncertainty	0.47 percent

- (4) The overall uncertainty in the activity, N_0 , was formed by taking three times the quadratic combination of the standard deviations of the mean, or approximations thereof, for the following:

a) 9 liquid-scintillation measurements	0.15 percent
b) source preparation	0.07 percent
c) dead time	0.05 percent
d) corrections for peak overlap	0.4 percent
e) scintillator stability	0.05 percent
f) gamma-ray efficiency correction	0.23 percent
g) gamma-ray probability per decay	<u>0.04 percent</u>
combined uncertainty	0.50 percent

NOTES. CONTINUED

- (5) The material from which this standard was prepared was examined with germanium detectors, and traces of ^{22}Na , ^{60}Co , and ^{65}Zn were observed at levels of less than 0.1 parts per million.
- (6) NCRP Report 58, 2nd Edition, p.418 (1985).
- (7) " ^{109}Pd and ^{109}Cd Activity Standardization and Decay Data", C. Ballaux, B.M. Coursey and D.D. Hoppe, submitted for publication (1986) in International Journal of Radiation Applications and Instrumentation, Part A.

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