

National Bureau of Standards Certificate

Standard Reference Material 4202D

Radioactivity Standard

Radionuclide	Cadmium-109
Source identification	SRM 4202-D-
Source description	Point source on polyester tape ^{(1)*}
88-keV gamma-ray-emission rate	$\gamma \text{ s}^{-1}$ (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 ± 0.4 days ⁽⁶⁾
Measuring instrument	$^{4\pi}\gamma$ 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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NOTES

- (1) The source consists of a dried deposit of cadmium as the chloride on a disk of 0.55 mg/cm² MYLAR supported by 8.1 mg/cm² polyester tape and covered by a second layer of the thicker tape only. The tape is retained on an aluminum annulus of 5.4-cm outer diameter and 3.8-cm inner diameter.
- (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 activity for this source, N_0 , in units of Bq, may be obtained by multiplying the emission rate by 27.115, which was the ratio of the activity to the emission rate results. The overall uncertainty in the activity 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. Hoppes, submitted for publication (1986) in International Journal of Radiation Applications and Instrumentation, Part A.

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