

National Bureau of Standards

Certificate

Standard Reference Material 4334C

Alpha-Particle Solution Standard

Radionuclide	Plutonium-242
Source identification	4334C
Source description	Liquid in 5-mL flame-sealed glass ampoule (1)*
Source mass	5.84 ± 0.07 grams (2)
Solution composition	Plutonium-242 in 5 M HNO ₃ (3)
Radioactivity concentration	5.436 Bq g ⁻¹
Reference time	February 1, 1987
Overall uncertainty	0.96 percent (4)
Radionuclidic impurities	See Table 1 (5)
Half life	(3.76 ± 0.02) x 10 ⁵ years (6)
Measuring instrument	4π liquid-scintillation counter and 0.8π defined-solid-angle counter

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
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Stanley D. Rasberry, Chief
Office of Standard Reference Materials

*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) The standard deviation is 0.07 grams based on mass measurements of 12 ampoules.
- (3) Solution density 1.160 g cm⁻³ at 21.5 °C.
- (4) 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) α-particle emission rate measurements (n=10) | 0.11 percent |
| b) gravimetric measurements | 0.10 percent |
| c) background | 0.20 percent |
| d) detection efficiency | 0.20 percent |
| e) impurities | 0.02 percent |
- (5) The values for ²³⁸Pu, ²³⁹Pu, and ²⁴⁰Pu are based upon analyses performed at Lawrence Livermore Laboratory. The values for ²⁴¹Pu and ²⁴¹Am are based on analyses done at NBS.
- (6) NCRP Report No. 58, 2nd edition, 1985 p. 506.

For further information please contact Dr. Bert M. Coursey at 301-975-5539 or Dr. Kenneth Inn at 301-975-5541.

TABLE 1
 Radionuclidic Impurities in SRM 4334C
 Plutonium-242 Alpha-Particle Solution Standard

Radionuclide	Half Life (years)	LLL Mass Spectrometric ^a Ratio to ²⁴² Pu as of February 19, 1975	Activity Ratio to ²⁴² Pu February 1, 1987
²³⁸ Pu	87.74±0.04 ^b	--	(1.64±0.05) x 10 ⁻⁴ ^c
²³⁹ Pu	24119±26 ^d	(0.33±0.05) x 10 ⁻⁶	(5.1±0.8) x 10 ⁻⁶
²⁴⁰ Pu	6564±11 ^b	(2.62±0.14) x 10 ⁻⁶	(1.50±0.09) x 10 ⁻⁴
²⁴¹ Pu	14.35±0.10 ^e	--	(9.6±0.7) x 10 ⁻²
²⁴¹ Am	432.2±0.5 ^b	--	(2.5±0.2) x 10 ⁻³

- a) Johnson, P.D., Carver, R.D., and Dupzyk, R.J., Preparation of ²⁴²Pu for shipment, Lawrence Livermore Laboratory, Private Communication, February 19, 1975.
- b) NCRP Report No. 58, 2nd edition (1985).
- c) LLL reported the activity ratio as (1.80 ± 0.05) x 10⁻⁴ on February 19, 1975.
- d) Strohm, W.W. Int. J. Appl. Radiat. Isot. 29, 481 (1978).
- e) Nuclear Data Sheets 44, 407 (1985).