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National Bureau of Standards

Certificate

Standard Reference Material 4309-F

Gaseous Radioactivity Standard

Radionuclide	Xenon-127
Source identification	4309F-
Source description	Gas in a flame-sealed spherical borosilicate-glass container (1)*
Gas composition	Xenon-127 and inactive xenon (2)
Activity	x 10 Bq
Reference time	1200 EST February 8, 1983
Random uncertainty	0.22 percent (3)
Systematic uncertainty	1.49 percent (4)
Total uncertainty (Random plus systematic)	1.71 percent
Photon-emitting impurities (Activity ratios at reference time)	None observed (5)
Half life	36.34 ± 0.02 days (6)
Measuring instrument	NBS pressurized "4π"γ ionization chamber B calibrated by internal gas-proportional counting

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

Washington, D.C. 20234
March, 1983

George A. Uriano, Chief
Office of Standard Reference Materials

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FOOTNOTES

(1) Approximate ampoule specifications:

volume	34 cm^3
outside diameter	4.5 cm
wall thickness	0.10 ± 0.02 cm

There is also an uncertainty of ± 0.25 mm in the location of the center of the spherical ampoule, due to possible nonsphericity.

(2) Pressure - 13 kPa (100 Torr) ± 20%.

(3) Half the 99-percent confidence interval of the mean (2.756 times the standard deviation of the mean computed from 30 ionization-chamber measurements).

(4) Linear sum of estimated uncertainty limits due to:

a) transfer of calibration from ionization chamber A to ionization chamber B, which is the linear sum of the estimated uncertainty limits due to:

1) half the 99-percent confidence interval of the mean of nine sets of ionization-chamber measurements	0.15 percent
2) photon attenuation in walls of the aluminum ampoule holders	0.10 percent
3) radium-226 reference-sources ratio	0.05 percent

b) calibration of pressurized "4π"γ ionization chamber A, which is the linear sum of the estimated uncertainty limits due to:

1) half the 99-percent confidence interval of the mean of 51 gas counting measurements	0.40 percent
2) gram-mole measurements	0.1 percent
3) extrapolation of the gas-counting data	0.2 percent
4) dilution of sources for gas counting	0.4 percent
5) half the 99-percent confidence interval of the mean for 40 ionization chamber measurements	0.19 percent
6) radium-226 reference sources ratios	0.2 percent

(5) Limits of detection as a percentage of the gamma-ray-emission rate of the 202.84-keV gamma rays emitted in the decay of xenon-127 are

0.1 percent between 40 keV and 198 keV
0.01 percent between 208 keV and 1900 keV,

provided that impurity photons are separated in energy by 5 keV or more from photons emitted in the decay of xenon-127.

(6) NBS measured half life

On the Use of Xenon-127 Gaseous Radioactivity Standard

SRM 4309-F

When this Standard Reference Material and the following table of gamma-ray probabilities per decay* are used to measure the efficiency as a function of energy of a photon spectrometer system, the attenuation in the glass walls of the 34 cm^3 ampoule must be considered. The attenuation corrections given in the table were determined with a Ge(Li)-spectrometer system with a resolution of 0.86-KeV full width at half maximum at 122 KeV and a source to detector distance of 25 cm. For a germanium-spectrometer system of appreciably poorer resolution, or a NaI(Tl)-spectrometer system, the tabulated attenuations would be maximum values.

Energy (KeV)	Gamma-ray probability per decay of ^{127}Xe (%)	Glass attenuation (%)
202.84	68.3 ± 0.4	3.2
172.10	25.5 ± 0.8	3.3
374.96	17.2 ± 0.6	2.8
145.22	4.29 ± 0.14	3.5
57.60	1.33 ± 0.06	7.0

*Gamma-ray energies and probabilities per decay taken from NCRP Report No. 58, p. 376, 1978. Uncertainties correspond to about a 68% probability.