U. S. Department of Commerce
Malcolm Baldrige
Secretary

National Bureau of Standards
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National Bureau of Standards

Certificate

Standard Reference Material 4307H

Gaseous Radioactivity Standard

Radionuclide	Xenon-133
Source identification	4307H-
Source description	Gas in a flame-sealed spherical borosilicate-glass container (1)*
Gas composition	Xenon-133 and inactive xenon (2)
Activity	Bq
Reference time	1200 EST April 11, 1983
Random uncertainty	0.26 percent (3)
Systematic uncertainty	1.59 percent (4)
Total uncertainty (Random plus systematic)	1.85 percent
Photon-emitting impurities (Activity ratios at reference time)	$^{133m}Xe/^{133}Xe$: 0.00004 ± 20% (5) $^{131m}Xe/^{133}Xe$: 0.037 ± 10%
Half life	5.245 ± 0.006 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
April, 1983

George A. Uriano, Chief
Office of Standard Reference Materials

*Notes on back

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 (3.707 times the standard deviation of the mean computed from 6 sets of 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 six sets of ionization-chamber measurements	0.26 percent
2) gas transfer losses	0.1 percent
3) photon attenuation in walls of the aluminum ampoule holders	0.10 percent
4) impurities	0.1 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 three series of gas-counting measurements	0.66 percent
2) extrapolation of the gas-counting data	0.22 percent
3) half the 99-percent confidence interval of the mean of three series of ionization-chamber measurements	0.01 percent
4) radium-226 reference sources ratios	0.14 percent

(5) Limits of detection as a percentage of the gamma-ray-emission rate of the 81-keV gamma rays emitted in the decay of xenon-133 are

0.1 percent between 40 keV and 76 keV
0.01 percent between 76 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-133.

(6) L.M. Cavallo, F.J. Schima, and M.P. Unterweger, Phys. Rev. C10, 2631, 1974.

Notes on the Use of Xenon-133 Gaseous Radioactivity Source

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When this source is 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, 4.5 percent, for the 0.081-MeV gamma ray was determined using a Ge(Li)-spectrometer system with a resolution ot 0.86-keV full width at half maximum at 122 keV. For a germanium-spectrometer system of poorer resolution, or a NaI(Tl)-spectrometer system, the attenuation would be less than 4.5 percent.