

U.S. Department of Commerce
Elliot L. Richardson,
Secretary

National Bureau of Standards
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Certificate

Standard Reference Material 4309

Xenon-127

Gaseous Radioactivity Standard

This Standard Reference Material consists of xenon-127 and inactive xenon in a flame-sealed, almost spherical, borosilicate-glass ampoule having a volume of approximately 34.5 cm³, an outside diameter of 4.2 cm, and wall thickness of approximately 0.12 cm. The pressure of the gas in the ampoule is approximately 2.67 x 10⁴ pascals (200 torr).

The activity of the xenon-127 in the ampoule as of 1200 EST October 1, 1976 was

$$* \quad s^{-1} \pm 1.5\%.$$

Forty-eight ampoules were quantitatively filled, by cryogenic transfer, with xenon-127 and inactive xenon and flame-sealed. The ratios of the quantities of xenon-127 in the ampoules were confirmed by measurements in a "4π"γ ionization chamber, and the gas contained in one of these ampoules was cryogenically transferred to, and its activity measured in, the National Bureau of Standards length-compensated internal gas proportional counters.

The uncertainty in the activity, 1.5 percent, is the linear sum of 0.4 percent, which is the limit of the random error at the 99-percent confidence level (2.797 S_m, where S_m is the standard error computed from 26 measurements), in the activity of the sample measured in the gas proportional counters, and the estimated upper limit of conceivable systematic errors, 1.1 percent, which includes the systematic uncertainties in the gas counting measurements, and in the quantitative transfers.

(over)

A half-life of 36.41 ± 0.02 days (M. J. Martin, Ed., ORNL - 5114, p. 32, 1976) was used to correct the data which were taken over a period of ten days. The gamma-ray spectra of a number of sources were examined, at the time of preparation, with a Ge(Li) spectrometer in the energy region of 0.050 MeV to 1.900 MeV, and no photon-emitting impurities were detected. The lower detection limits for the detection of photons emitted from radionuclidic impurities can be expressed as a percentage of the emission rate of the 0.375-MeV gamma-ray for energies above 0.375 MeV and as a percentage of the emission rate of the 0.203-MeV gamma-ray for energies below 0.375 MeV. These limits are approximately 0.2 percent for photon energies below 0.203 MeV, 0.1 percent for photon energies between 0.203 and 0.375 MeV, and 0.01 percent for photon energies above 0.375 MeV. Approximately 6.5 months after target separation, the activities of $^{129\text{m}}\text{Xe}$ and $^{131\text{m}}\text{Xe}$, formed during the production of the ^{127}Xe , impurities were estimated to be less than 0.002 and 0.025 percent, respectively, of the total ^{127}Xe activity. These estimates were based on measurements of previous material that had been produced under similar conditions and that had aged about eight weeks after target separation.

This Standard Reference Material was prepared and calibrated in the Center for Radiation Research, Radioactivity Section, W. B. Mann, Chief.

Washington, D.C. 20234
October, 1976

J. Paul Cali, Chief
Office of Standard Reference Materials

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The following table taken from M. J. Martin, Ed., ORNL - 5114, p. 32, 1976, is provided for the convenience of the user of this standard.

| <i>Energy (keV)</i> | <u>γ-probability per disintegration of ^{127}Xe (%)</u> |
|-------------------------|---|
| 202.84 | 68 \pm 4 |
| 172.10 | 25.4 \pm 1.5 |
| 374.96 | 17.7 \pm 1.1 |
| 145.22 | 4.12 \pm 0.24 |
| 57.60 | 1.29 \pm 0.11 |