U.S. Department of Commerce
Juanita M. Kreps
Secretary

National Bureau of Standards
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National Bureau of Standards

Certificate

Standard Reference Material 4207

Cesium-137-Barium-137m

Point-Source Radioactivity Standard

This Standard Reference Material consists of cesium-137-barium-137m deposited, as the chloride, on polyester tape approximately 0.006-cm thick and covered with another layer of the same tape. The tape is mounted on an aluminum annulus 3.8-cm inside diameter and 5.4-cm outside diameter.

This Standard Reference Material is a dried deposit from an accurately weighed aliquant of a master solution from dilutions of which quantitative sources were prepared in 1968 and recently intercompared, by measurement in the NBS "4π"γ pressure-ionization chamber with the national cesium-137 standards. The activity of the national standards was determined by $4\pi\beta$-γ efficiency-extrapolation coincidence and anti-coincidence counting using cesium-134 as a tracer; the number of cesium-137 atoms was measured by mass-spectrometric isotope dilution in terms of natural cesium chloride of known cesium concentration.

The activity of the cesium-137 in the point source at 1200 EST September 12, 1979, was

$$* \quad \times 10^{5}\ s^{-1} \pm 1.61\%*.$$

The uncertainty in the activity, 1.61 percent, is the linear sum of 0.05 percent, which is the limit of the random error at the 99-percent confidence level (2.7 S_m, where S_m is the standard error calculated from 40 ionization-chamber measurements) and 1.56 percent, which is the linear sum of the estimated upper limits of conceivable systematic error.

Assuming a gamma-ray probability per decay of 0.850 ± 0.005, the number of 0.6616-MeV gamma rays of barium-137m emitted per second, at 1200 EST September 12, 1979, was

$$* \quad \times 10^{5} \pm 2.20\%*.$$

The uncertainty in the gamma-ray-emission rate, 2.20 percent, is the linear sum of 0.59 percent, which is the uncertainty associated with the gamma-ray probability per decay, and 1.61 percent, which is the uncertainty attributable to the activity.

The number of cesium-137 atoms at 1200 EST September 12, 1979, was

$$* \quad \times 10^{14} \pm 0.68\%*.$$

(over)

The uncertainty in the number of atoms, 0.68 percent, is the linear sum of 0.10 percent, which is the limit of the random error at the 99-percent confidence level of the mass-spectrometric measurements (3.355 S_m, where S_m is the standard error calculated from independent measurements of 9 samples) and 0.58 percent, which is the linear sum of the estimated upper limits of conceivable systematic error.

The solution from which this Standard Reference Material was prepared was examined for photon-emitting impurities and none was observed. Conservative detection limits for photons from possible impurities, expressed as percentages of the gamma-ray-emission rate of the 0.6616-MeV gamma rays emitted in the decay of barium-137m, are approximately 0.1 percent for photons with energies between 0.090 MeV and 0.657 MeV, and 0.01 percent for those between 0.667 MeV and 1.900 MeV.

This Standard Reference Material was prepared and the activity determined in the Center for Radiation Research, Radiation Physics Division, Radioactivity Group, W.B. Mann, Principal Scientist. Solutions for mass-spectrometric analyses were prepared jointly by L.M. Cavallo, Radioactivity Group and by L.A. Machlan and T.J. Murphy, Inorganic Analytical Research Division. The mass-spectrometric measurements were made in the Inorganic Analytical Research Division by E.L. Garner.

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George A. Uriano, Chief
Office of Standard Reference Materials

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Revised from December, 1968.