U. S. Department of Commerce
Frederick B. Dent
Secretary
al Bureau of Standards
l W. Roberts, Director

National Bureau of Standards

Certificate

Standard Reference Material 4233

Cesium-137 Burn-Up Standard

This Standard Reference Material consists of cesium-137 in equilibrium with its daughter product, barium-137m, in 5.1934 ± 0.0093 grams of solution in a flame-sealed glass ampoule. The carrier concentration is 28 micrograms of high purity CsCl per gram of approximately 2.7N HCl.

One hundred ampoules were prepared: each was measured in the NBS $4\pi\gamma$ ionization chamber; the solution in twenty of the ampoules was weighed. The average weight of solution in the hundred ampoules, 5.1934 grams, was interpolated from the average weight of solution in the twenty weighed ampoules and the ionization-chamber measurements of the hundred ampoules, assuming a proportional relationship between weight of solution and ionization-chamber response. The uncertainty, 0.0093 gram, is the range of the ionization-chamber measurements.

The number of cesium-137 atoms per gram of solution at 0001 EST December 15, 1972, was:

$$*4.64_9 \times 10^{14} \pm 0.5_2\ \%*.$$

The $^{137}Cs/^{133}Cs$ ratios of ten samples of the master solution were determined by surface-ionization mass spectrometry. The mass spectrometer is a 12-inch radius-of-curvature 68°-analyzer-tube instrument and uses a single-filament platinum-ribbon ion source.

The uncertainty in the number of atoms, 0.5_2 percent, is the sum of 0.2_7 percent, which is the 99-percent confidence limit of the mass-spectrometric measurements, ($3.25\ S_m$, where S_m is the standard error computed from ten determinations), and 0.2_5 percent, which is the linear sum of the estimated upper limits of conceivable systematic errors associated with the same measurements.

The number of 0.6616-MeV gamma rays of barium-137m emitted per second per gram of solution at 0001 EST December 15, 1972, was:

$$*2.98 \times 10^{5} \pm 2.2\ \%*.$$

The gamma-ray-emission rate was based on interpolative measurement in the National Bureau of Standards $4\pi\gamma$-ionization chamber, for which the ionization current per gamma ray is a linear function of mean gamma-ray energy over the range from 0.2 MeV to 1.5 MeV.

The uncertainty in the gamma-ray-emission rate, 2.2 percent, is the sum of 0.2 percent, which is the range of the ionization- chamber measurements, and 2.0 percent, which is the linear sum of the estimated upper limits of conceivable systematic errors.

Washington, D. C. 20234
April 25, 1973

J. Paul Cali, Chief
Office of Standard Reference Materials

(over)

The gamma-ray spectrum of this material was examined with a Ge(Li)-spectrometer and cesium-134 was found to be present. On January 26, 1973, the ratio of the activities of cesium- 134 to cesium-137 was $1.42 \times 10^{-4} \pm 7$ percent.

A half-life of 30 years was assumed for decay corrections. Half-life measurements and gamma-ray spectrum analyses will be made periodically and users of this material will be notified of the results when feasible.

This Standard Reference Material was prepared, and the gamma-ray-emission rate determined and solutions for spectrometric analyses were fabricated in the Center for Radiation Research, Radioactivity Section, W. B. Mann, Chief. The mass spectrometric measurements were made by E. L. Garner of the Analytical Mass Spectrometry Section, W. R. Shields, Chief.