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

National Bureau of Standards
Ernest Ambler, Acting Director

National Bureau of Standards Certificate

Standard Reference Material 4307-B

Gaseous Radioactivity Standard

Xenon-133

This Standard Reference Material consists of xenon-133 and inactive xenon in a flame-sealed, almost spherical, borosilicate-glass ampoule having a volume of approximately 34.5 cm^3, 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 1.34 x 10^3 pascals (10 torr).

The activity of the xenon-133 in the ampoule as of 1200 EST November 15, 1976 was

* s^{-1} ± 2.82%*.

Forty ampoules were filled, by cryogenic transfer, with xenon-133 and inactive xenon and flame-sealed. The ampoules were intercompared with a selected standard of the same material in a 5.0-cm diameter "4π"γ pressure ionization chamber. The selected standard was measured, with respect to a radium-226 reference source, in the National Bureau of Standards 2.5-cm diameter "4π"γ pressure ionization chamber, which had previously been calibrated, in terms of a radium-226 reference source, using the National Bureau of Standards length-compensated internal gas-proportional counters. The activity of the xenon-133 in the selected standard was determined by taking into account the relative efficiencies of this chamber for xenon-133, xenon-131m, and xenon-133m.

The uncertainty in the activity, 2.82 percent, is the linear sum of 0.19 percent, which is the limit of the random error at the 99-percent confidence level (5.841 S_m, where S_m is the standard error computed from 4 measurements), and the estimated upper limit of conceivable systematic errors, 2.63 percent, which includes the uncertainty in the calibration of the selected standard.

A half life of 5.245 days ± 0.11 percent for xenon-133 is recommended (L. M. Cavallo, F. J. Schima, and M. P. Unterweger, Phys. Rev. 10, 2631, 1974).

The material, from which these sources were prepared, was examined on a Ge(Li)-spectrometer system and the presence of the known production impurities of xenon-133m and xenon-131m was detected. As of the time of certification, the ratio of the activity of xenon-131m to that of xenon-133 was 2.1 percent, whereas the ratio of the activity of xenon-133m to that of xenon-133 was less than 0.03 percent and may be neglected in the subsequent use of this standard. Any other radionuclide emitting a photon with an energy of less than 0.081-MeV and an emission rate greater than 10^{-3} of the 0.081-MeV gamma ray of xenon-133 would have been detected; the corresponding limit for any photon with energy greater than 0.081-MeV is 10^{-4}.

(over)

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

J. Paul Cali, Chief
Office of Standard Reference Materials

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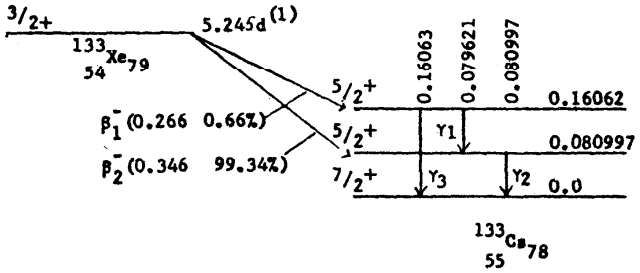
SRM 4307-B

I. Decay Scheme: Radioactive Atoms - Supplement I (ORNL-4923)
M. J. Martin. (Nov. 1973).



Radiation	Energy (MeV)	Intensity %	Conversion Coefficients	Fluorescence Yield
β_1^-	$0.266_{max.} \pm 0.003$	0.66±0.10		
β_2^-	$0.346_{max.} \pm 0.003$	99.34±0.10		
γ_1	0.079621±0.000011	0.22±0.06	K=1.40±0.04 K/L=6.4±1.2 MNO/L=0.33 α_T=1.69±0.08	
ce_{1K}	0.04363±0.00001	0.30±0.08		
ce_{1L}	0.07390±0.00001	0.047±0.010		
ce_{1MNO}	0.07840±0.00001	0.016±0.004		
γ_2	0.080997±0.000005	37.1±0.4	K=1.40±0.02 L/K=0.163±0.003 M/L=0.233±0.014 NO/M=0.18±0.02 α_T=1.69±0.03	
ce_{2K}	0.045008±0.000005	52.0±0.3		
ce_{2L}	0.075279±0.000005	8.5±0.2		
ce_{2M}	0.079776±0.000005	2.0±0.2		
ce_{2NO}	0.080762±0.000005	0.35±0.05		
X_L	0.0043	6±2		
$X_{K\alpha 2}$	0.03062	13.3±0.3		0.895±0.012 (2)
$X_{K\alpha 1}$	0.03097	24.6±0.4		
$X_{K\beta}$	0.0350	8.9±0.2		
γ_3	0.16063±0.00004	0.06±0.02	K=0.20±0.01	
ce_{3K}	0.12466±0.00007	0.012±0.004		

1. NBS half life Phys. Rev. 10, 2631, 1974.
2. Reviews of Modern Physics 44, 716, 1972.

Please note: Three weak gamma rays of energies 0.221 MeV, 0.302 MeV and 0.382 MeV have not been included because of their low intensities.