U. S. Department of Commerce
derick B. Dent
Secretary

Bureau of Standards
W. Roberts, Director

National Bureau of Standards Certificate

Standard Reference Material 4306-B

Radioactivity Standard

Xenon-133

This Standard Reference Material consists of xenon-133 and inactive xenon sealed in a pyrex ampoule having a volume of about 5 ml, a length of 4.5 cm and a diameter of 1.5 cm. The pressure of the gas in the ampoule is about atmospheric.

The total activity in nuclear transformations per second at 1200 EST September , 1974, was

* *.

Twenty ampoules were mounted on manifolds and ten ampoules filled at the same time with isotopically pure xenon-133, isolated by means of the NBS electromagnetic isotope separator, and inactive xenon. This sample was measured in the NBS "4π" γ ionization chamber which has been calibrated with sources which were measured using the NBS length-compensated internal-gas counters.

The uncertainty in the activity, percent, is the linear sum of percent, which is the 99-percent confidence limit (i.e. S_m, where S_m is the standard error calculated from readings), and the estimated upper limits of the conceivable systematic errors.

A half life of 5.245 days ± 0.11 percent for xenon-133 is suggested. This value is the mean of the half lives of the 6 sources used to calibrate the "4π" γ ionization chamber. Each was evaluated from a minimum of 31 sets of measurements made over a period of 45 days. Twenty sets of Ge(Li)-spectrometer measurements on each of 3 sources made over 26 days confirmed this value. The uncertainty, 0.14 percent, is the linear sum of 0.05 percent, which is the 99-percent confidence limit, and 0.06 percent, which is the estimated uncertainty due to the non-linearity of the chamber.

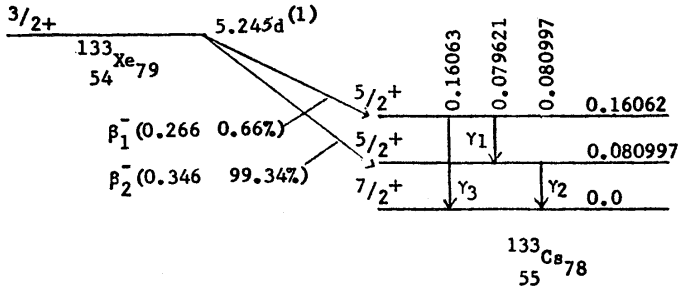
This Standard Reference Material was prepared and calibrated in the Center for Radiation Research, Radioactivity Section, W. B. Mann, Chief.

Washington, D. C. 20234
September, 1974

J. Paul Cali, Chief
Office of Standard Reference Materials

Xenon-133

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



Radiation	Energy (MeV	Intensity %	Conversion Coefficients	Fluorescence Yield
β_1^-	$0.266_{max.}$ ±0.003	0.66±0.10		
β_2^-	$0.346_{max.}$ ±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 αT=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 αT=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

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.

II. Attenuation

The average wall thickness of the gas ampoules is 0.132 ± 0.007 cm. Ionization-chamber measurements were made on one third of the sources with and without a glass shell of the same composition and wall thickness. The average ratio of the intensity transmitted through the additional thickness of glass to the incident intensity was ± . The uncertainty, ± , are the limits between which 99 percent of the values are expected to lie with 99 percent certainty.