U. S. Department of Commerce
Maurice H. Stans
Secretary

Bureau of Standards
Brandscomb, Director

Certificate

STANDARD REFERENCE MATERIAL 4213

Gamma-Ray Standard

Americium-241

This standard consists of americium-241 electroplated onto a 0.010-cm-thick platinum foil which is covered with a 0.005-cm-thick aluminum foil. The aluminum-covered source is sandwiched between two layers of 0.036-cm-thick polyurethane-film tape. The diameter of the radioactive area is approximately 0.2 cm.

The total number of nuclear transformations per second on February 19, 1970, was

* * .

This standard was calibrated by comparing its gamma-ray-emission rate with those of NBS working standards of americium-241. The working standards had previously been calibrated in the NBS $1\pi\alpha$ scintillation counter.

The uncertainty in the activity, 1.3_6 percent, is the sum of 0.6_6 percent, which is the limit of the random error at the 99-percent confidence level of the gamma-ray intercomparison and the activities of the working standards, and 0.7_0 percent, which is the maximum uncertainty due to the estimated systematic errors in both sets of measurements.

Using the nuclear constant 0.353 ± 0.005 for the abundance of the 59.5-keV gamma ray (the value adopted by the Nuclear Data Group at the Oak Ridge National Laboratory), the number of these gamma rays emitted per second on February 19, 1970, was

* * .

The material from which this standard was prepared was examined for impurities with both Ge(Li)-gamma-ray and n-type silicon surface-barrier alpha-particle spectrometers and no impurities were observed.

A half life of 433 ± 2 years, the value adopted by the Nuclear Data Group at the Oak Ridge National Laboratory, is suggested.

This standard was prepared and calibrated in the Center for Radiation Research, Nuclear Radiation Division, by members of the Radioactivity Section, W. B. Mann, Chief.

Washington, D.C. 20234
May 1970

J. Paul Cali, Acting Chief
Office of Standard Reference Materials

4213-

On the Use of ^{241}Americium Gamma-Ray Standards

SRM 4211 and SRM 4213

In determining photopeak efficiency with this source, it is important to note that there will be some degradation of the 59.5-keV gamma-ray energy due to Compton scattering in the source-covering materials. The change in the photopeak counting rate is dependent on the geometrical efficiency and the resolution of the detector employed.

Assuming polyurethane to have twice as many hydrogen atoms as carbon atoms, and using the X-ray attenuation coefficients for carbon, hydrogen and aluminum (NBS Circular 583), the calculated number of scattered 59.5-keV photons, in a direction perpendicular to the plane of the source, is 1.1%; however, the net loss of photopeak counts is less than 1.1%. For example: at NBS a 2-cm^3 Ge(Li)-detector system with a full width at half maximum of 2.5 keV was used with the americium-241 source at a distance of approximately 2 inches. Measurements were made with and without a test absorber, and the loss of photopeak counts, with the absorber, was 0.6%.

A test absorber which is of similar construction to the source-covering materials is included with the standard, so the effect cited may be assessed for each experimental arrangement.

Another effect to be considered is the backscatter from the platinum source mount. Referring to NBS Circular 542, the scattered-photon energies of 60-keV gamma rays at 90° and 180° scatter are 53.4 keV and 48.5 keV respectively. With high-resolution detectors, complications from source-mount backscatter can, with care, be avoided.

For more information refer to:

1. NBS Circular 542: Graphs of the Compton Energy-Angle Relationship and the Klein-Nishima Formula for 10 keV to 500 MeV. 1953.

2. Beta and Gamma-Ray Spectroscopy, Kai Siegbahn, 1955, Chapt. II, Charlotte M. Davisson, fig. 3, p. 34.

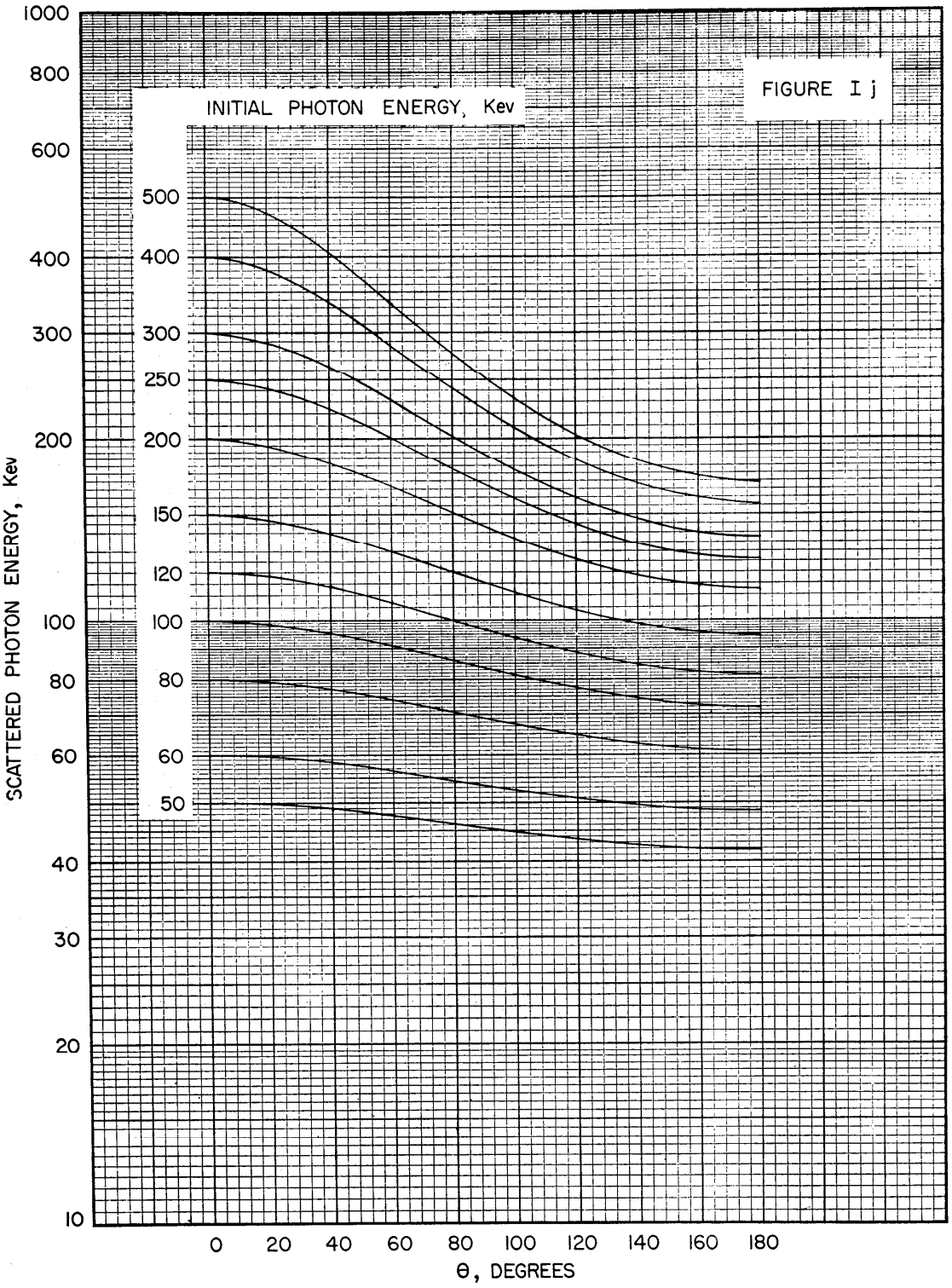
FIGURE I j
INITIAL PHOTON ENERGY, Kev
500
400
300
250
200
150
120
100
80
60
50
SCATTERED PHOTON ENERGY, Kev
1000
800
600
400
300
200
100
80
60
40
30
20
10
0
20
40
60
80
100
120
140
160
180
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