



DEPARTMENT OF ENERGY  
 CHICAGO OPERATIONS OFFICE  
 NEW BRUNSWICK LABORATORY, D-350  
 9800 SOUTH CASS AVENUE  
 ARGONNE, ILLINOIS 60439

DOCKETED  
 USNRC

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 OFFICE OF SECRETARY  
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 BRANCH

August 26, 1982

Secretary of the Commission  
 U.S. Nuclear Regulatory Commission  
 Washington, DC 20555

DOCKET NUMBER  
 PROPOSED RULE PR - Misc. Notice  
 (Reg Guide)

Attn: Docketing and Service Branch

Dear Sir/Madam:

A proposed revision to Regulatory Guide 5.21 - Nondestructive Uranium -235 Enrichment Assay by Gamma-Ray Spectrometry - has been circulated for comment. Members of the technical staff of the New Brunswick Laboratory have reviewed the document and offer the following comments:

1. The numerical value assigned to the emission rate of 185.7 - keV gamma rays per gram of U-235 stated in Section 13, pp. 2,3, is dependent upon values for the half-life and the gamma-ray branching intensity. A range of emission rates differing by nearly 8% ( $4.26 - 4.60 \times 10^4$ ) can be calculated using widely accepted published values (see Attachment). In the calibration procedures discussed in Section C.4, any systematic error in gamma-ray emission rate cancels out. In other procedures, such as the so-called "intrinsic calibration" frequently used with Ge(Li) detectors, the systematic error in gamma-ray emission rate may be in part incorporated into the calibration response-- depending upon what curve fitting options are selected. No discussion is given, nor reference provided, for the source of the quoted emission rate ( $4.3 \times 10^4$  gammas/g sec).
2. P. 15, para 5, line 2 - Suggest replacing "agitated" with "tumbled". Tumbling is believed to achieve better mixing of canned particles whereas "agitation", if interpreted to mean vibration on a horizontal surface, might tend to compact and order the material by density or particle size.

DS09 Ed Hill  
 add: 5650 NZ

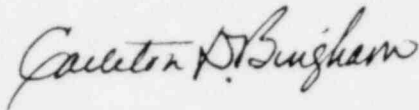
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Acknowledged by card. 8/31/82 emp

August 26, 1982

If additional information relative to the above comments is desired, it will be supplied upon request.

Sincerely,

A handwritten signature in cursive script that reads "Carleton D. Bingham".

Carleton D. Bingham  
Director

Enclosure:  
As stated

cc: S. McDowell, OSS, HQ, w/encl.

ATTACHMENT TO COMMENTS ON REGULATORY GUIDE 5.21

The gamma-ray emission rate of a radioactive material may be calculated as follows:

-  $\frac{dn}{dt} = \lambda N$  decay rate is proportional to quantity of material  
 [disintegrations/sec  $\propto$  number of atoms present]

$\lambda N b$  = gamma-ray emission rate,

where  $b$  = branching fraction  $\equiv$  gammas emitted per disintegration

$a$  = gamma-ray emission rate =  $\frac{\ln 2}{t_{1/2}} \cdot \frac{W}{A} \cdot \tilde{N} \cdot b$ , gammas/sec-g

where  $\ln 2$  = natural logarithm of 2 = 0.69315

$W$  = mass of U-235 present, g  $\equiv$  1

$\tilde{N}$  = Avogadro's Constant =  $6.022045 \times 10^{23}$  atom/mole

$A$  = nuclide mass of U-235 = 235.0439

$t_{1/2}$  = half life of nuclide, sec

$a = 5.628 \times 10^{13} \frac{b}{t_{1/2}(y)}$

$b = 0.54$

quoted in Lederer, C.M., et al. "Table of Isotopes, Seventh Edition" from E.K. Hyde, et al., The Nuclear Properties of the Heavy Elements, Vol. II, Prentice Hall, Eaglewood Cliffs, NJ (1964)

$= 0.561$

Augustson, and Reilley, T.D. LA-5651 from Gunnick and Tinney UCRL - 51086

$= 0.575 \pm 0.009$

Vaninbrouckx, R., et al., "The Determination of Gamma-Ray Emission Probabilities in the Decay of  $^{235}\text{U}$  and  $^{231}\text{Th}$ ", Proceedings of the 5th Symposium on X- and  $\gamma$ -Ray Sources and Applications, June 10, 1981, Ann Arbor, MI, North Holland (1982)

$t_{1/2} = 7.0385 \times 10^8$

quoted in Lederer, et al. loc cit from Jaffey, A.H., et al. Physical Review, C 4, 1889 (1971)

$= 7.0 \times 10^8$

quoted in DeBievre, Pure & Applied Chemistry 47, p 94 Pergamon Press (1976)

$= 7.129 \times 10^8$

from Augustson and Reilley, loc cit