DEPARTMENT OF ENERGY
CHICAGO OPERATIONS OFFICE
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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 (4.3×10^4 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
add: Ed Tell
5650 NL

Acknowledged by card. 8/31/82 emp

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

Sincerely,

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 emmission rate of a radioactive material may be calculated as follows:

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

λNb = gamma-ray emission rate,
where b = branching fraction ≡ gammas emitted per disintegration

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

where $\ln 2$ = natural logarithm of 2 = 0.69315
W = mass of U-235 present, g ≡ 1
$\tilde{N}$ = Avogadro's Constant = 6.022045×10^{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, R and Reilley, T.D. LA-5651 from Gunnick and Tinney UCRL - 51086
$= 0.575 \pm 0.009$	Vaninbroukx, R., et al., "The Determination of Gamma-Ray Emission Probabilities in the Decay of ^{235}U and ^{231}Th", Proceedings of the 5th Symposium on X-and γ-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