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A TABULATION OF THE ISOTOPIC COUNTING CORRECTION FACTORS  
AND DECAY SCHEMES

By

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November 16, 1956

REPOSITORY POL  
COLLECTION I-131 Atmosphere  
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FOLDER N/A

RADIOLOGICAL CHEMICAL ANALYSIS OPERATION

HANFORD LABORATORIES

Hanford Atomic Products Operation

General Electric Co.

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ABSTRACT

This report serves the two-fold purpose of presenting a tabulation of the correction factors used in determining the absolute activity of various isotopes and serving as a guide for all groups within the Radiological Chemical Analysis Operation. The results reported were selected as the most valid after careful scrutinization of all available data and are specific to the measuring methods and equipment employed within the Operation.

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FIGURE - 1  
FIRST SHELF SOURCE DIAMETER CORRECTIONS  
( $f_d$ ) FOR FLAT CIRCULAR SOURCE MOUNTING

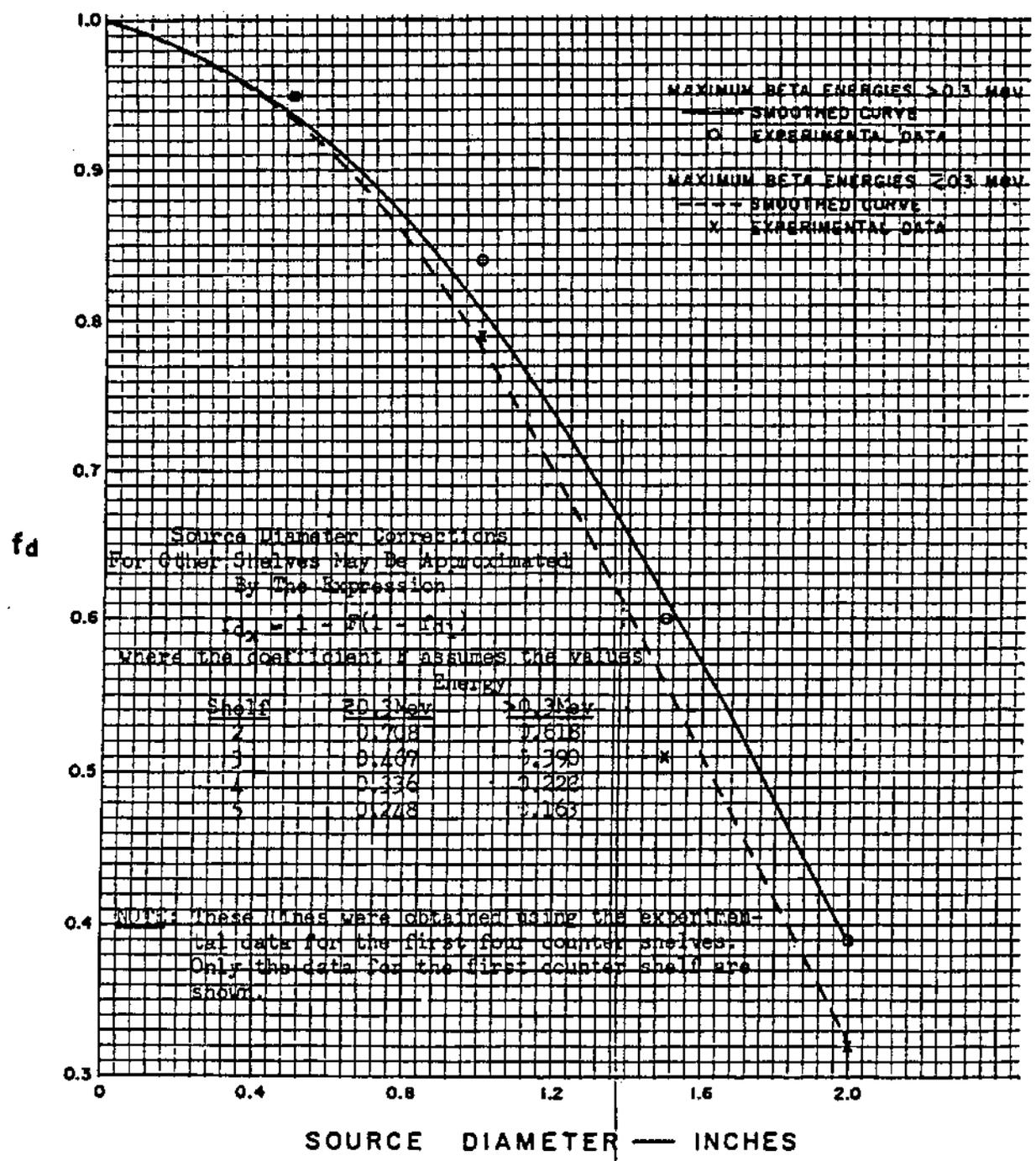


FIGURE - 3  
 FIRST SHELF BACKSCATTER CORRECTIONS  
 ( $f_{bs}$ ) FOR STANDARD BACKING MATERIALS

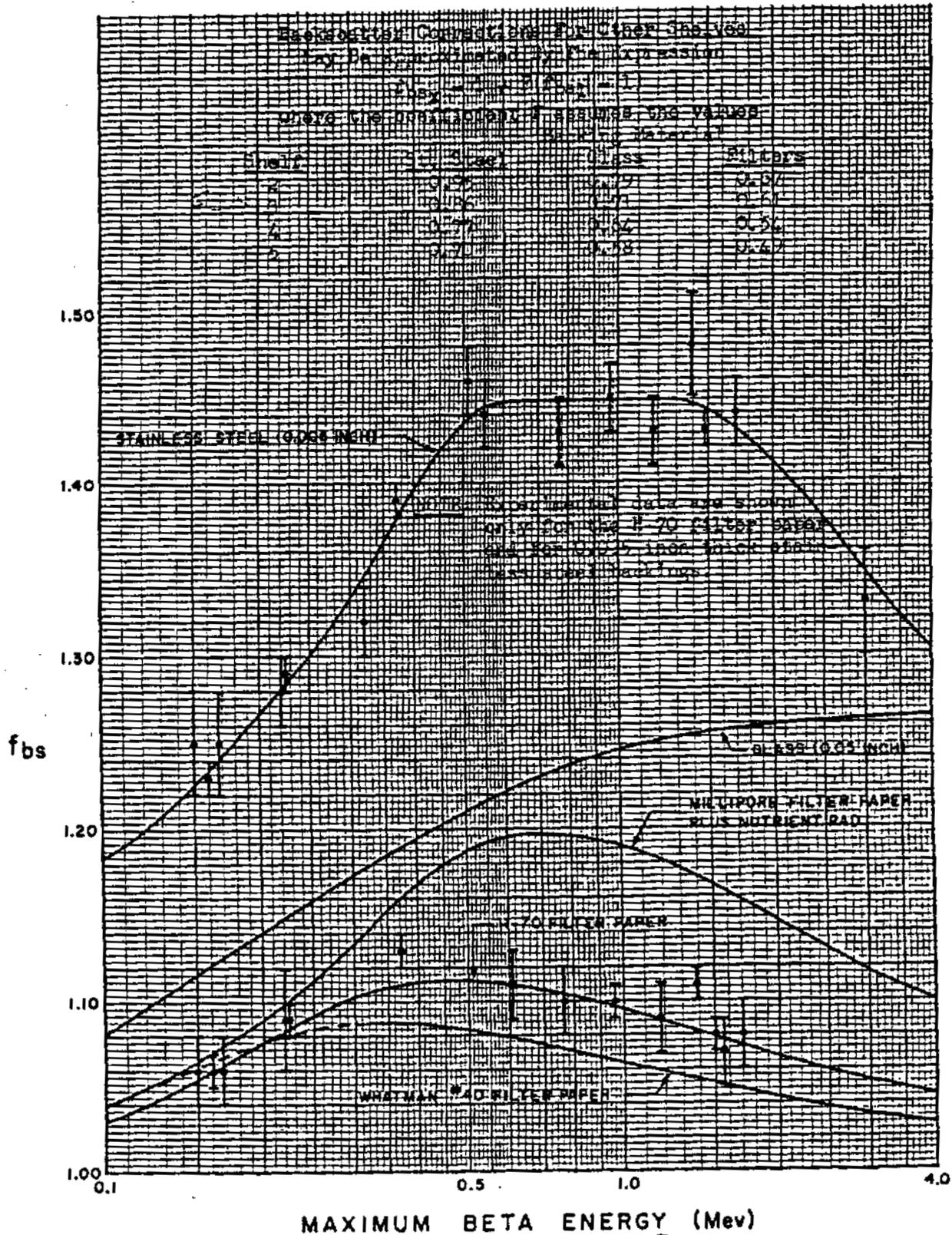
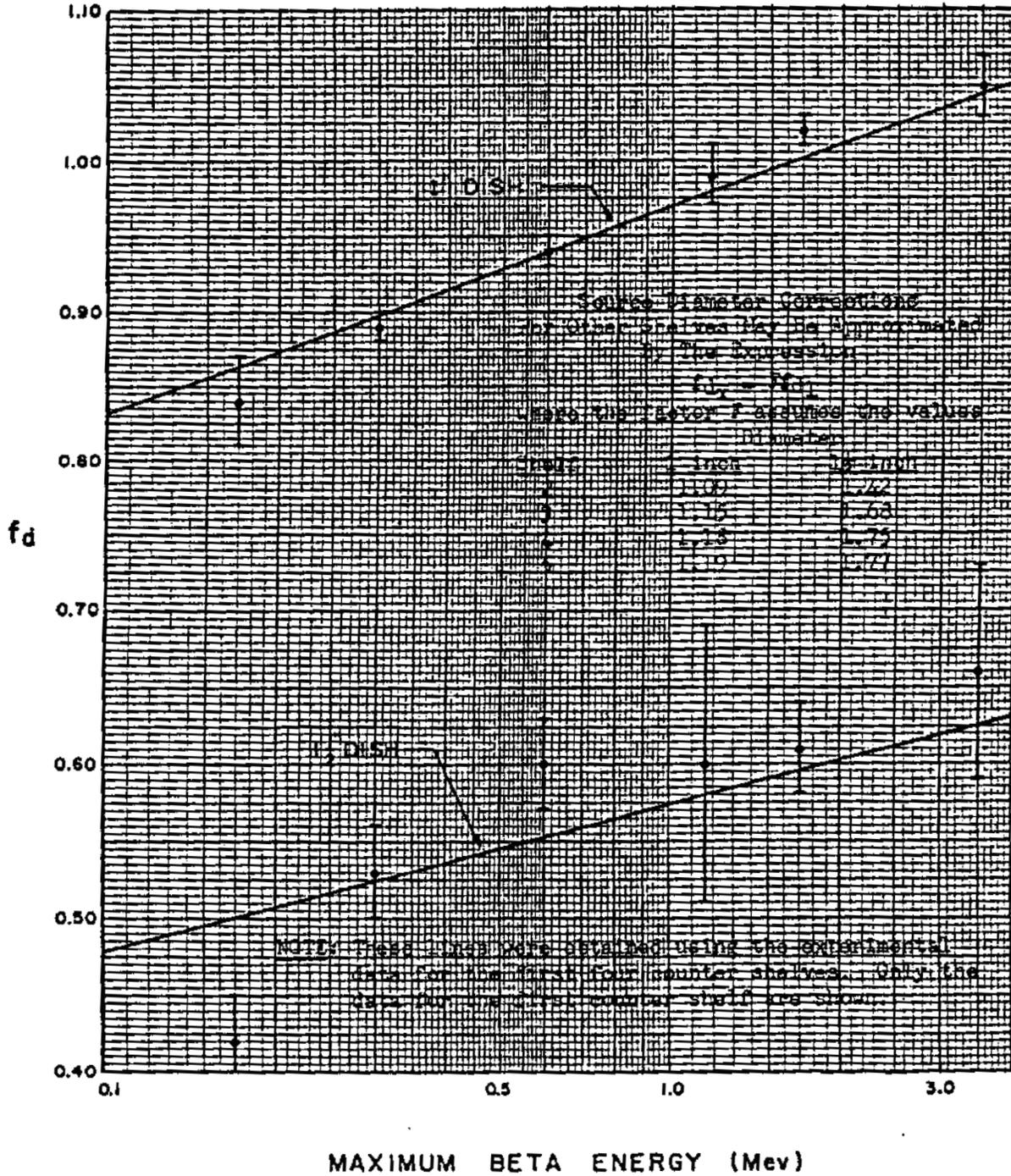


FIGURE - 2  
FIRST SHELF SOURCE DIAMETER CORRECTIONS  
( $f_d$ ) FOR STAINLESS STEEL DISHES

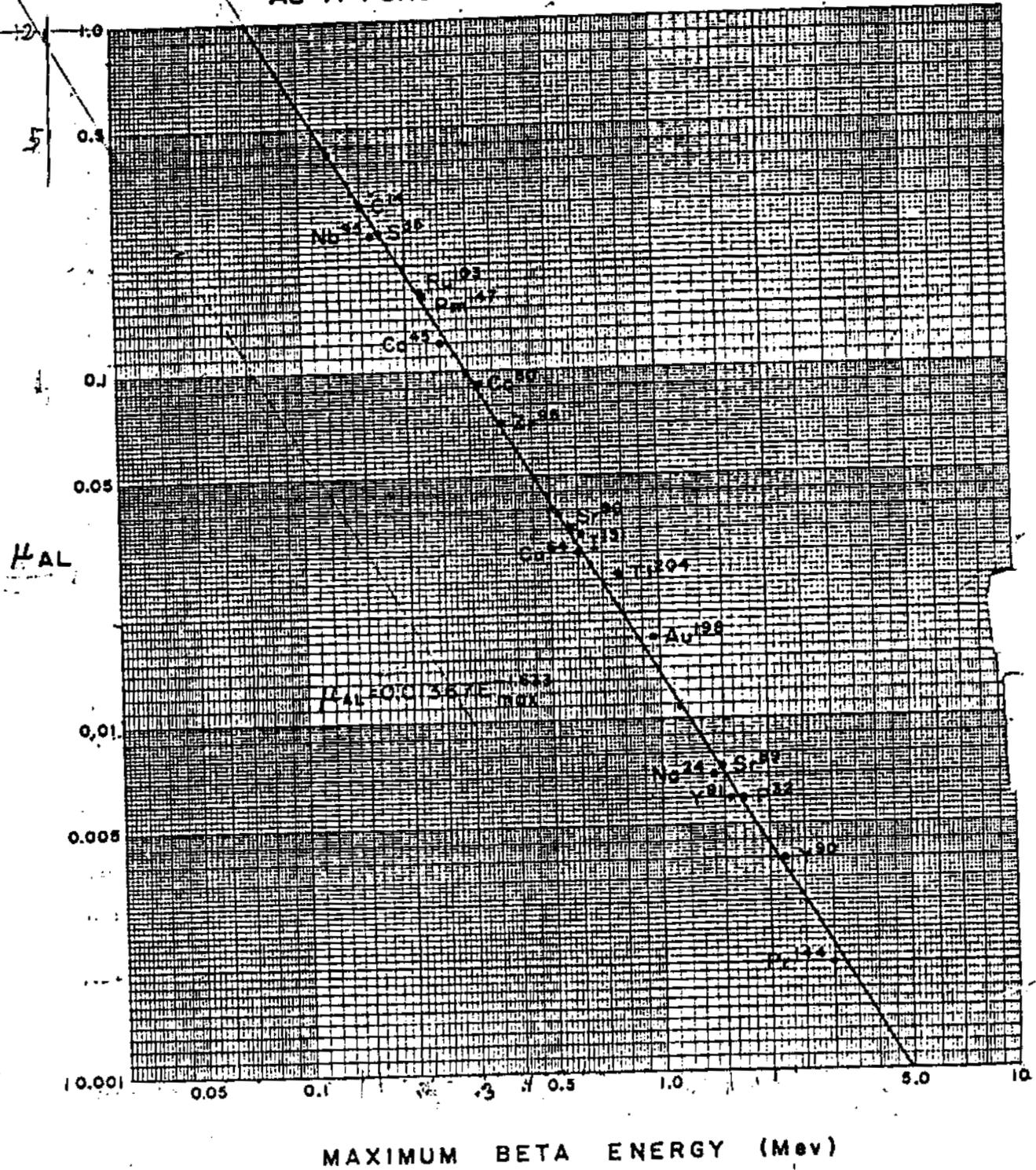


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FIGURE - 4  
MASS ABSORPTION COEFFICIENT  
AS A FUNCTION OF MAXIMUM ENERGY



$\mu_{AL}$

MAXIMUM BETA ENERGY (MeV)

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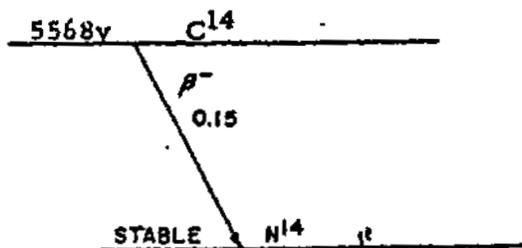
44-68 RICHLAND, WASH.

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ISOTOPE Carbon<sup>14</sup>

METHOD Distillation

YIELD 100% = 32.8 mg. (10mg. CO<sub>3</sub><sup>2-</sup>)  
(As BaCO<sub>3</sub>)



$\mu_{Al} = 0.303$   $\mu_{Air} =$  *new Tube*

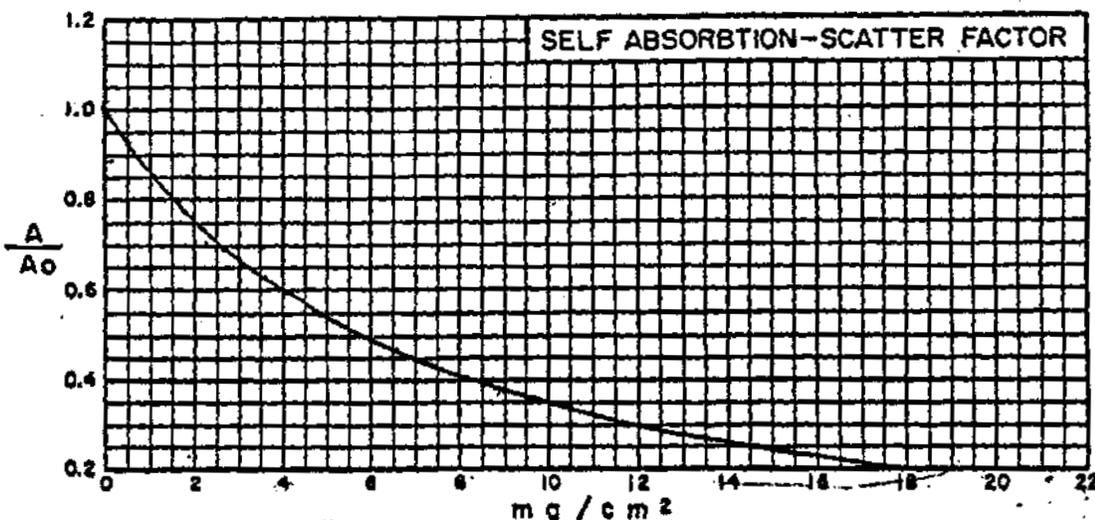
SHELF	AIR & MICA WINDOW FACTORS
1	0.24 (.59)
2	0.19 (.44)
3	0.11 (.36)

SOURCE SPREAD DIAMETER FACTORS

MOUNTING EFFECTIVE AREA	1" S.S. DISH 4.5 cm <sup>2</sup>	1 1/2" S.S. DISH 10 cm <sup>2</sup>	1" GLASS (FLAT) 5.0 cm <sup>2</sup>	1.38" MILLIPORE 9.6 cm <sup>2</sup>	1 1/2" FILTER 13 cm <sup>2</sup>
SHELF 1	0.86	0.44	0.78	0.61	0.50
SHELF 2	0.94	0.68	0.84	0.72	0.65
SHELF 3	0.99	0.74	0.90	0.82	0.77

BACK-SCATTER FACTORS

SHELF 1	1.22	1.22	1.12	1.09	1.06
SHELF 2	1.21	1.21	1.09	1.06	1.04
SHELF 3	1.19	1.19	1.09	1.05	1.04

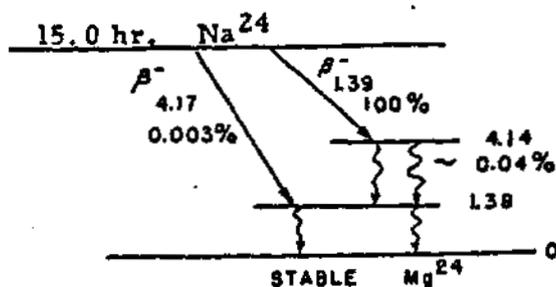


CALCULATION PROCEDURE:  $\frac{C/m \text{ (VOLUME FACTOR)}}{(Geo)(2.2 \times 10^6)(S.S.)(ba.)(S.S.A)(A+M.W.)(Yield)} = \mu C/\text{unit}$

Remarks: C<sup>14</sup> as BaCO<sub>3</sub> on 1 1/2" Dish 1st shelf

METHOD Group Elimination

YIELD 37.0mg = 100% (10mg Na)  
(As NaNO3)



$\mu_{\text{Al}} = 0.0079$   $\mu_{\text{Air}} =$  \_\_\_\_\_

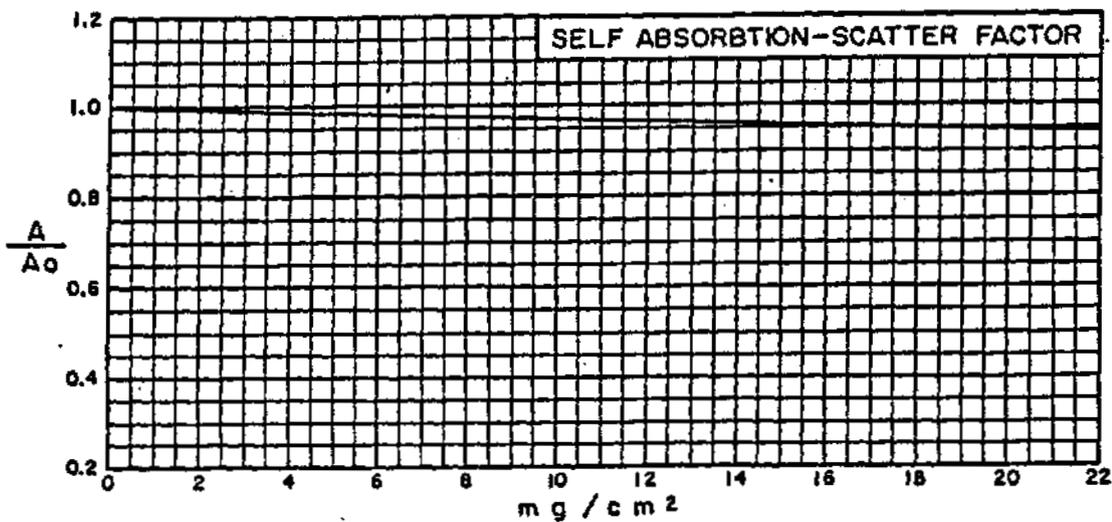
SHELF	AIR & MICA WINDOW FACTORS
1	0.97
2	0.96
3	0.94

SOURCE SPREAD DIAMETER FACTORS

MOUNTING EFFECTIVE AREA	1" S.S. DISH 4.5 cm <sup>2</sup>	1 1/2" S.S. DISH 10 cm <sup>2</sup>	1" GLASS (FLAT) 5.0 cm <sup>2</sup>	138" MILLIPORE 9.6 cm <sup>2</sup>	1 1/2" FILTER 13 cm <sup>2</sup>
SHELF 1	0.99	0.59	0.81	0.66	0.56
SHELF 2	1.08	0.84	0.88	0.79	0.73
SHELF 3	1.14	0.99	0.93	0.87	0.83

BACK-SCATTER FACTORS

SHELF 1	1.42	1.42	1.26	1.17	1.08
SHELF 2	1.39	1.39	1.21	1.11	1.05
SHELF 3	1.36	1.36	1.18	1.10	1.05



CALCULATION PROCEDURE:  $\frac{C/m \text{ (VOLUME FACTOR)}}{(\text{Geo.})(2.2 \times 10^6)(\text{S.S.})(\text{b.s.})(\text{S.S.A.})(\text{A}+\text{M.W.})(\text{Yield})} = \mu\text{C/unit}$

Remarks: Na24 in NaNO3 on 1" dishes

-9-  
ISOTOPE Phosphorus<sup>32</sup>

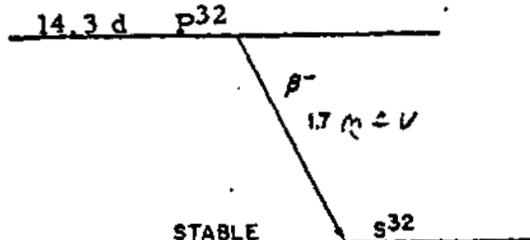
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METHOD Phosphomolybdate

YIELD 98.8 mg=100% (2.5 mg PO<sub>4</sub><sup>=</sup>)

(As (NH<sub>4</sub>)<sub>3</sub> (PMo<sub>12</sub>O<sub>40</sub>))

$\mu_{Al} = 0.0058 \mu_{Air} =$



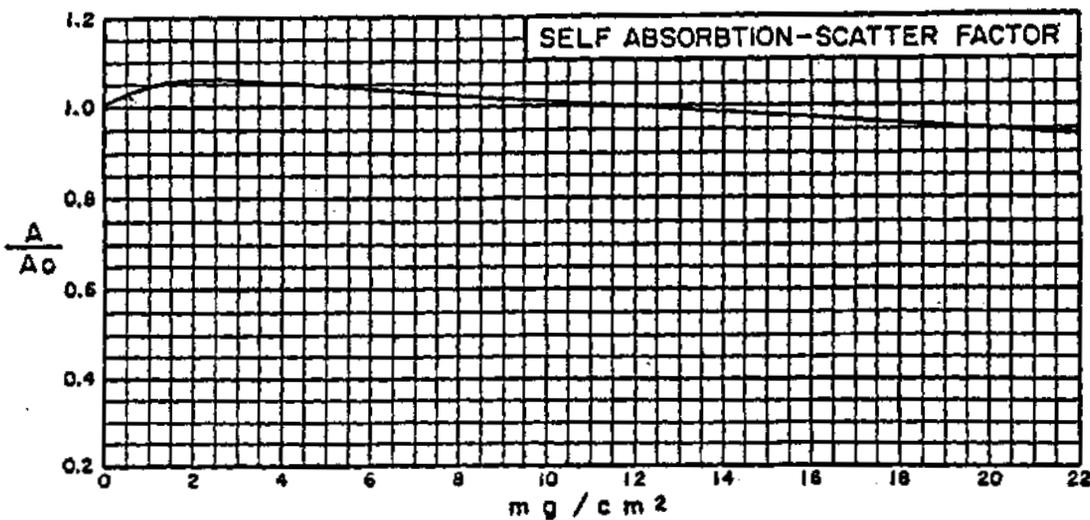
SHELF	AIR & MICA WINDOW FACTORS
1	0.98
2	0.97
3	0.96

SOURCE SPREAD DIAMETER FACTORS

MOUNTING EFFECTIVE AREA	1" S.S. DISH 4.5 cm <sup>2</sup>	1 1/2" S.S. DISH 10 cm <sup>2</sup>	1" GLASS (FLAT) 5.0 cm <sup>2</sup>	1.38" MILLIPORE 9.6 cm <sup>2</sup>	1 1/2" FILTER 13 cm <sup>2</sup>
SHELF 1	1.00	0.60	0.81	0.66	0.56
SHELF 2	1.09	0.85	0.88	0.79	0.73
SHELF 3	1.15	1.01	0.93	0.87	0.84

BACK-SCATTER FACTORS

SHELF 1	1.43	1.43	1.26	1.16	1.07
SHELF 2	1.41	1.41	1.21	1.11	1.05
SHELF 3	1.37	1.37	1.18	1.10	1.04



CALCULATION PROCEDURE:  $\frac{C/m \text{ (VOLUME FACTOR)}}{(\text{Geo.})(2.2 \times 10^6)(\text{S.S.})(\text{bs.})(\text{S.S.A.})(A+\text{M.W.})(\text{Yield})} = \mu\text{C/Unit}$

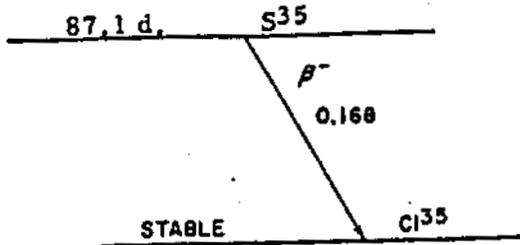
Remarks: P<sup>32</sup> in Ammonium Molybdiphosphate on 1" st. dishes (1st sh.)

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ISOTOPE Sulphur<sup>35</sup>

METHOD Barium Sulphate

YIELD 24.3 mg=100% (10 mg-SO<sub>4</sub><sup>=</sup>)  
(As BaSO<sub>4</sub>)



μ<sub>Al</sub> = 0.25 μ<sub>Air</sub> = *new*

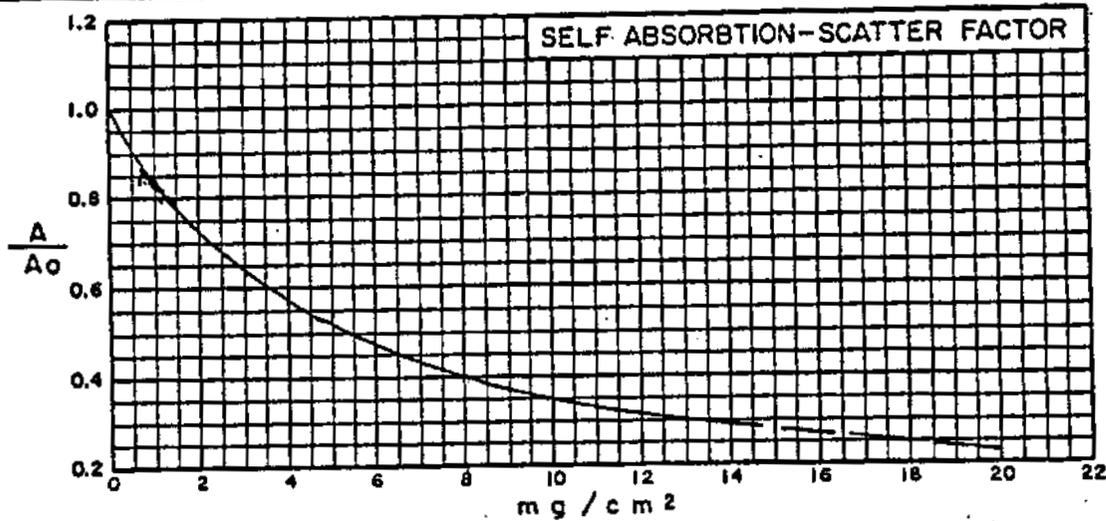
SHELF	AIR & MICA WINDOW FACTORS
1	0.40 (65)
2	0.25
3	0.16

SOURCE SPREAD DIAMETER FACTORS

MOUNTING EFFECTIVE AREA	1" S.S. DISH 4.5 cm <sup>2</sup>	1 1/2" S.S. DISH 10 cm <sup>2</sup>	1" GLASS (FLAT) 5.0 cm <sup>2</sup>	138" MILLIPORE 9.6 cm <sup>2</sup>	1 1/2" FILTER 13 cm <sup>2</sup>
SHELF 1	0.86	0.50	0.78	0.61	0.50
SHELF 2	0.94	0.71	0.84	0.72	0.65
SHELF 3	0.99	0.84	0.90	0.82	0.77

BACK-SCATTER FACTORS

SHELF 1	1.24	1.24	1.13	1.07	1.06
SHELF 2	1.23	1.23	1.10	1.05	1.04
SHELF 3	1.20	1.20	1.09	1.04	1.04



CALCULATION PROCEDURE:  $\frac{C/m \text{ (VOLUME FACTOR)}}{(\text{Geo.}) (2.2 \times 10^5) (\text{S.S.}) (\text{bs.}) (\text{S.S.A.}) (\text{A+M.W.}) (\text{Yield})} = \mu\text{C/unit}$

Remarks: S<sup>35</sup> as BaSO<sub>4</sub> on 1 1/2" dishes

ISOTOPE Potassium<sup>40</sup>

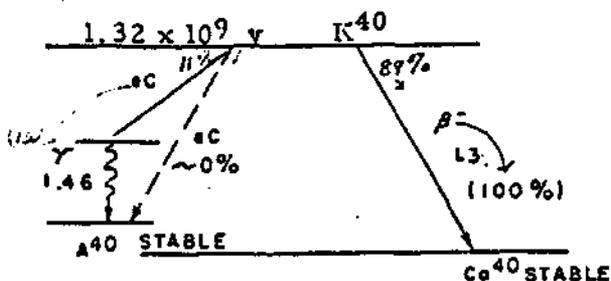
100-10-200 2/77

METHOD Perchlorate

YIELD 70.9 mg=100%

(As KClO<sub>4</sub>)

$\mu_{Al} = 0.009$   $\mu_{Air} =$



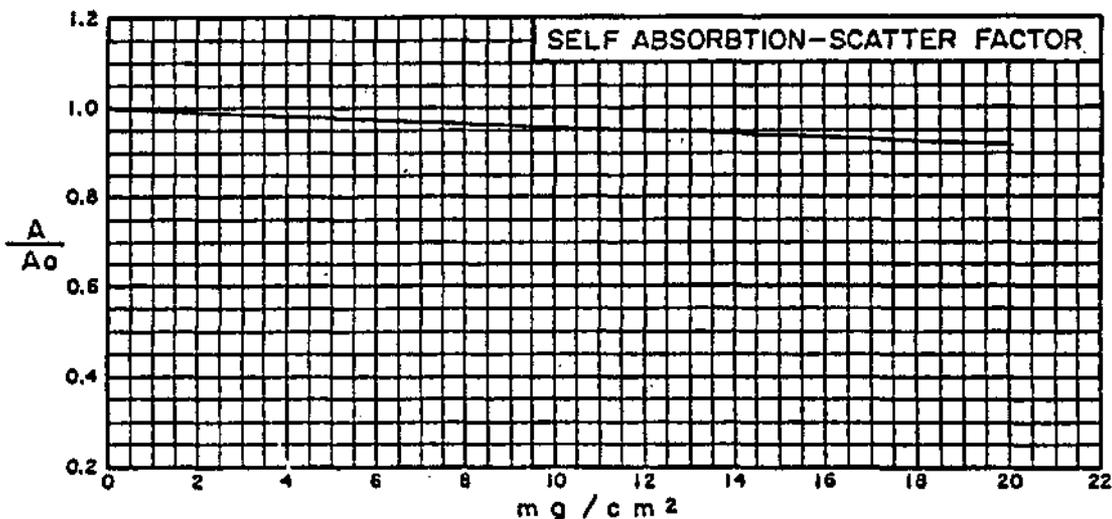
SHELF	AIR & MICA WINDOW FACTORS
1	0.97
2	0.95
3	0.94

SOURCE SPREAD DIAMETER FACTORS

MOUNTING EFFECTIVE AREA	1" S.S. DISH 4.5 cm <sup>2</sup>	1 1/2" S.S. DISH 10 cm <sup>2</sup>	1" GLASS (FLAT) 5.0 cm <sup>2</sup>	1.38" MILLIPORE 9.6 cm <sup>2</sup>	1 1/2" FILTER 13 cm <sup>2</sup>
SHELF 1	0.99	0.58	0.81	0.66	0.56
SHELF 2	1.08	0.82	0.88	0.79	0.73
SHELF 3	1.14	0.97	0.93	0.87	0.83

BACK-SCATTER FACTORS

SHELF 1	1.45	1.45	1.25	1.18	1.08
SHELF 2	1.43	1.43	1.20	1.12	1.05
SHELF 3	1.39	1.39	1.18	1.11	1.05

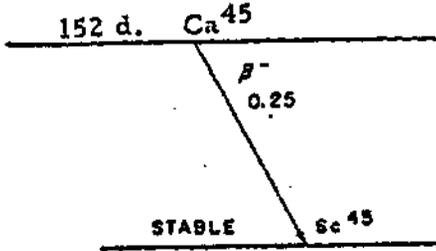


CALCULATION PROCEDURE:  $\frac{C/m \text{ (VOLUME FACTOR)}}{(\text{Geo.})(2.2 \times 10^6)(\text{S.S.})(\text{b.s.})(\text{S.S.A.})(A \cdot \text{M.W.})(\text{Yield})} = \mu\text{C/unit}$

ISOTOPE Calcium<sup>45</sup>

METHOD Calcium Oxalate

YIELD 36.5 mg=100% (10 mg Ca)  
(As CaC<sub>2</sub>O<sub>4</sub>)



$F_{Air} = 0.13$   $F_{Air} =$

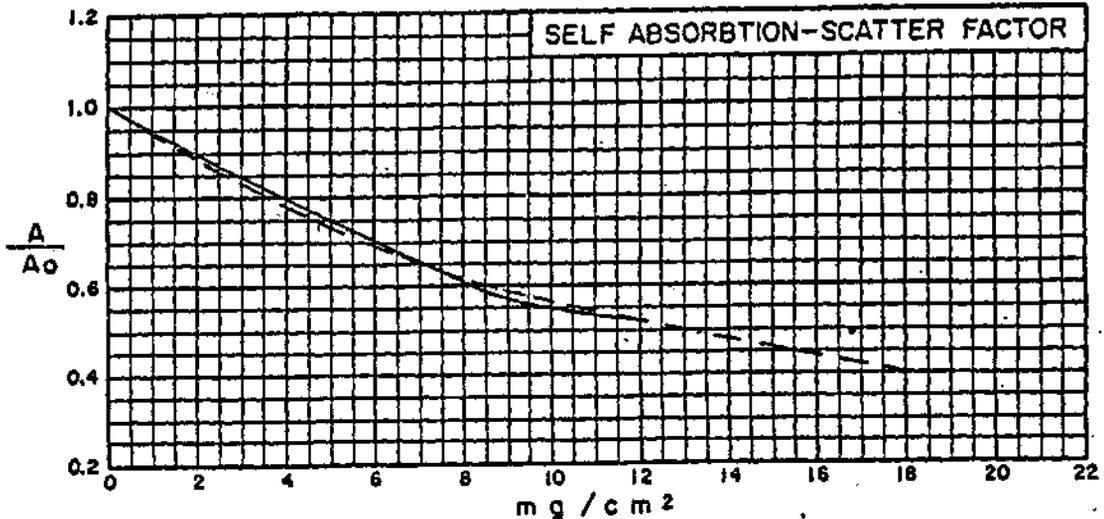
SHELF	AIR & MICA WINDOW FACTORS
1	0.62 (78)
2	0.49
3	0.38

SOURCE SPREAD DIAMETER FACTORS

MOUNTING EFFECTIVE AREA	1" S.S. DISH 4.5 cm <sup>2</sup>	1 1/2" S.S. DISH 10 cm <sup>2</sup>	1" GLASS (FLAT) 5.0 cm <sup>2</sup>	1.38" MILLIPORE 9.6 cm <sup>2</sup>	1 1/2" FILTER 13 cm <sup>2</sup>
SHELF 1	0.89	0.52	0.78	0.61	0.50
SHELF 2	0.97	0.74	0.84	0.72	0.65
SHELF 3	1.02	0.87	0.90	0.82	0.77

BACK-SCATTER FACTORS

SHELF 1	1.30	1.30	1.16	1.11	1.09
SHELF 2	1.29	1.29	1.13	1.07	1.06
SHELF 3	1.26	1.26	1.11	1.07	1.05



CALCULATION PROCEDURE:  $\frac{C/m \text{ (VOLUME FACTOR)}}{(Geo.) (2.2 \times 10^6) (S.S.) (bs.) (S.S.A.) (A+M.W.) (Yield)} = \mu C/\text{unit}$

Remarks: Ca<sup>45</sup> as CaC<sub>2</sub>O<sub>4</sub> in 1 1/2" dishes

$$--- = \frac{A}{A_0} = \frac{1}{\mu x} (1 - e^{-\mu x})$$

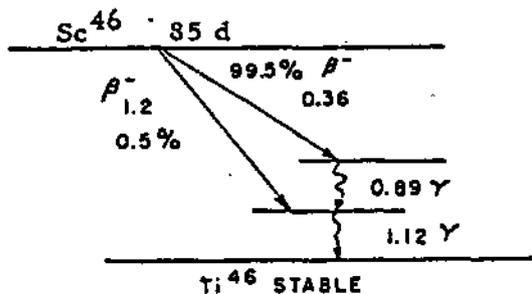
ISOTOPE Scandium<sup>46</sup>

METHOD Scandium Fluoride

YIELD 61.3 mg=100%

(As Sc<sub>2</sub>O<sub>3</sub>)

$\mu_{Al} = 0.072$   $\mu_{Air} =$



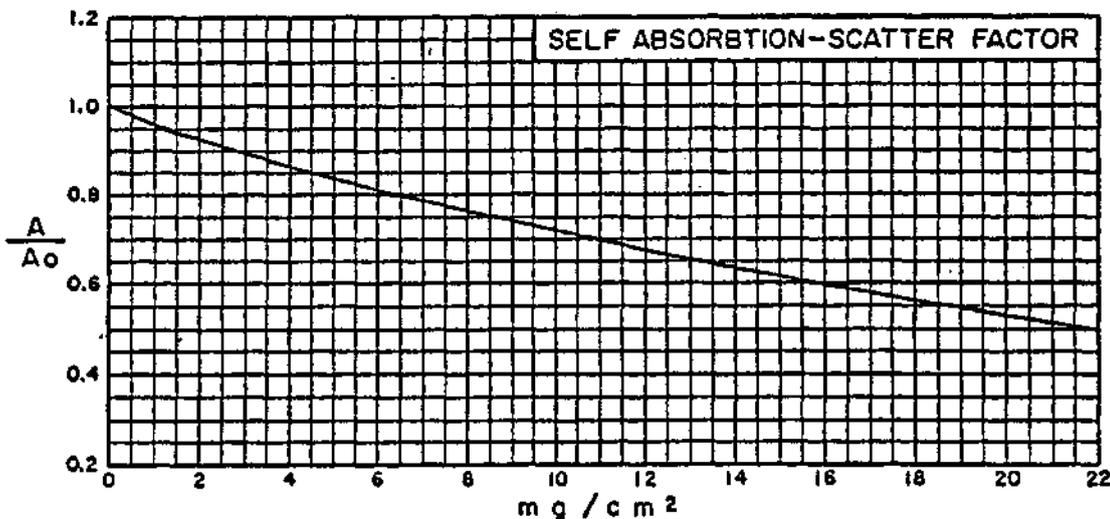
SHELF	AIR & MICA WINDOW FACTORS
1	0.77
2	0.67
3	0.59

SOURCE SPREAD DIAMETER FACTORS

MOUNTING EFFECTIVE AREA	1" S.S. DISH 4.5 cm <sup>2</sup>	1 1/2" S.S. DISH 10 cm <sup>2</sup>	1" GLASS (FLAT) 5.0 cm <sup>2</sup>	1.38" MILLIPORE 9.8 cm <sup>2</sup>	1 1/2" FILTER 13 cm <sup>2</sup>
SHELF 1	0.91	0.53	0.81	0.66	0.56
SHELF 2	0.99	0.75	0.88	0.79	0.73
SHELF 3	1.05	0.89	0.93	0.87	0.83

BACK-SCATTER FACTORS

SHELF 1	1.37	1.37	1.19	1.16	1.11
SHELF 2	1.35	1.35	1.15	1.11	1.07
SHELF 3	1.32	1.32	1.13	1.10	1.07



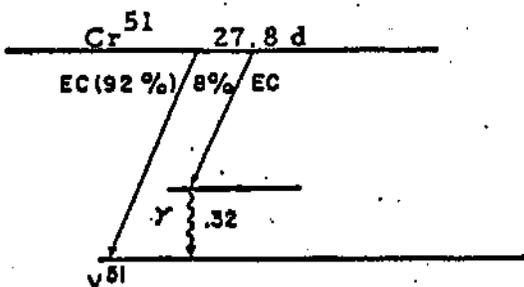
CALCULATION PROCEDURE:  $\frac{C/m \text{ (VOLUME FACTOR)}}{(Geo)(2.2 \times 10^6)(S.S.)(bs.)(S.S.A)(A+M.W.)(Yield)} = \mu C/\text{unit}$

Remarks:  $\frac{A}{A_0} = \frac{1 - e^{-\mu x}}{\mu x}$

ISOTOPE Chromium<sup>51</sup>

METHOD \_\_\_\_\_

YIELD \_\_\_\_\_



$\mu_{Al} =$  \_\_\_\_\_  $\mu_{Air} =$  \_\_\_\_\_

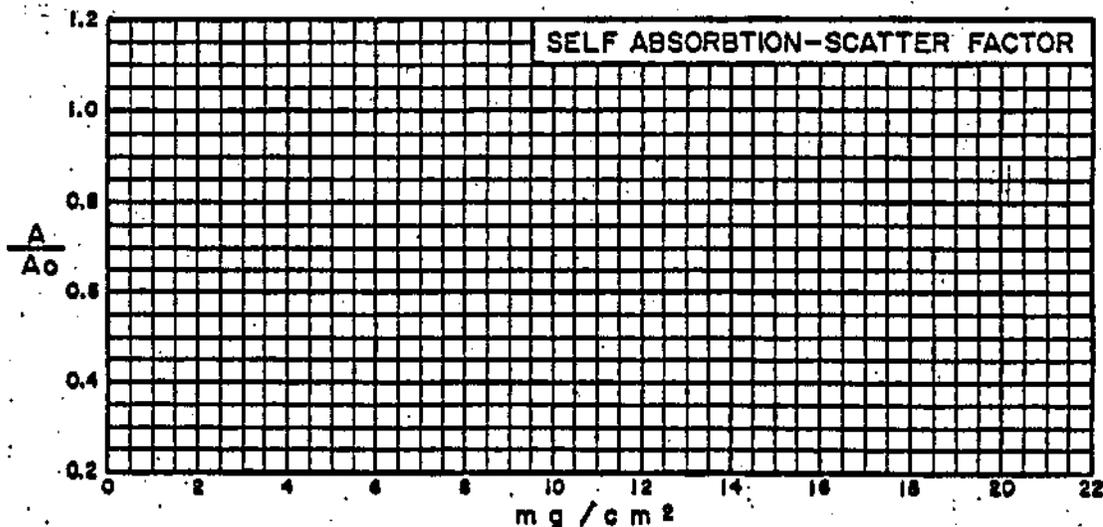
SHELF	AIR & MICA WINDOW FACTORS
1	
2	
3	

SOURCE SPREAD DIAMETER FACTORS

MOUNTING EFFECTIVE AREA	1" S.S. DISH 4.5 cm <sup>2</sup>	1 1/2" S.S. DISH 10 cm <sup>2</sup>	1" GLASS (FLAT) 6.0 cm <sup>2</sup>	1.38" MILLIPORE 9.5 cm <sup>2</sup>	1 1/2" FILTER 13 cm <sup>2</sup>
SHELF 1					
SHELF 2					
SHELF 3					

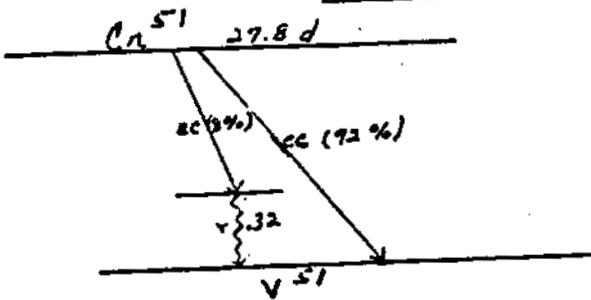
BACK-SCATTER FACTORS

SHELF 1					
SHELF 2					
SHELF 3					



CALCULATION PROCEDURE:  $\frac{C/m \text{ (VOLUME FACTOR)}}{(Geo)(2.2 \times 10^6)(S.S)(b.s.)(S.S.A)(A+M.W.)(Yield)} = \mu C/\text{unit}$

Chromium-51



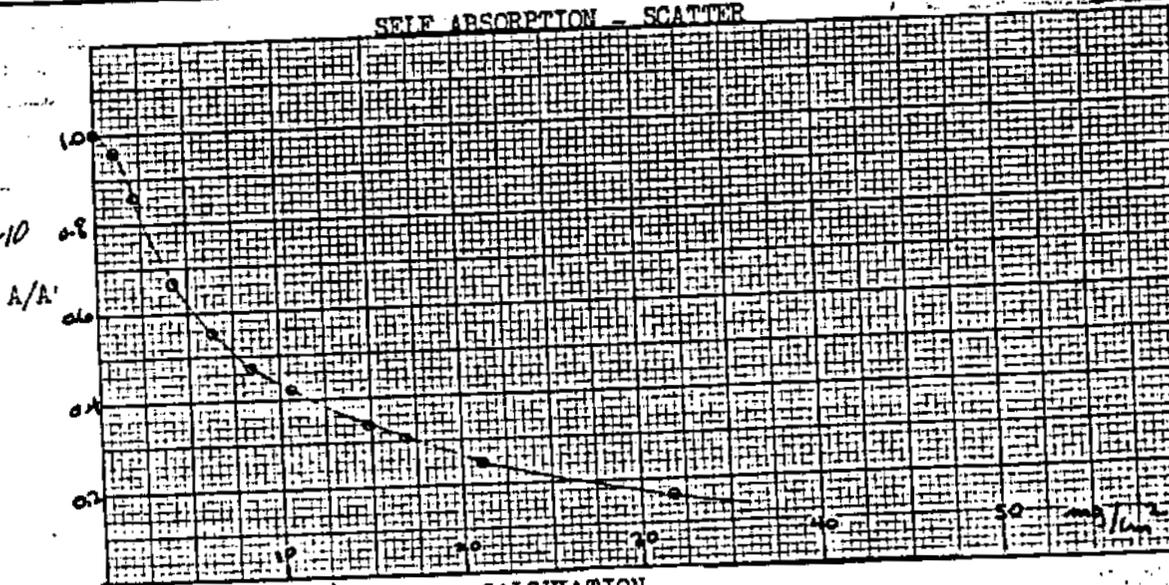
Shelf	NaI - Air & Mica Window Abs.	NaI - Air & Mica Window Abs.
1		
2		
3		
4		
5		

Shelf	SOURCE SPREAD			
	1" dish	1 1/2" dish	1 1/2" Filter	1.38" millipore
1	.79	.51	.51	.66
2	.84	.68	.68	.78
3				
4				
5				

460  
860

Shelf	BACKSCATTER			
	1" dish	1 1/2" dish	1 1/2" Filter	1.38" millipore
1	1.20*	1.20*	1.05*	1.05*
2	1.20*	1.20*	1.05*	1.05*
3				
4				
5				

SELF ABSORPTION - SCATTER



PCe-10  
A/A'

CALCULATION

$$\frac{(C/M) \text{ (Volume Factor)}}{(\text{Geo.}) (2.2 \times 10^6) \text{ (SS) (bs) (SSA) (A\&MW) (Yield)}} = \text{uc/unit}$$

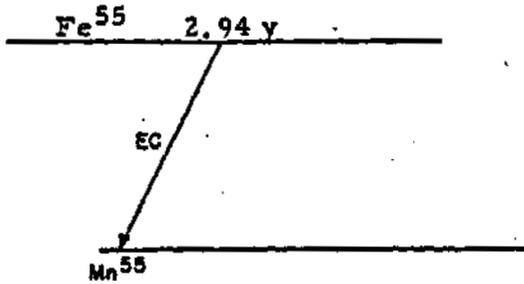
COMMON METHOD

\* Interpreted

ISOTOPE Iron<sup>55</sup>

METHOD \_\_\_\_\_

YIELD \_\_\_\_\_



$\mu_{Al} =$  \_\_\_\_\_  $\mu_{Alr} =$  \_\_\_\_\_

SHELF	AIR & MICA WINDOW FACTORS
1	_____
2	_____
3	_____

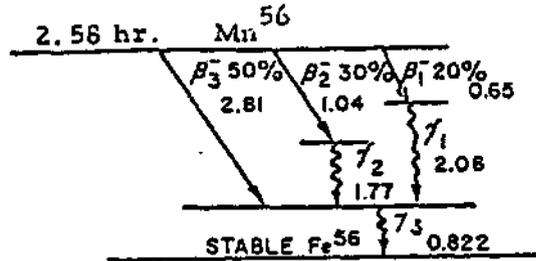
SOURCE SPREAD DIAMETER FACTORS

MOUNTING	1" S.S. DISH	1 1/2" S.S. DISH	1" GLASS (FLAT)	1.38" MILLIPORE	1 1/2" FILTER
EXPOSURE AREA	4.8 CM <sup>2</sup>	10 CM <sup>2</sup>	8.0 CM <sup>2</sup>	2.8 CM <sup>2</sup>	13 CM <sup>2</sup>

ISOTOPE Manganese<sup>56</sup>

METHOD Manganese Dioxide

YIELD 31.7 mg=100%  
(As MnO<sub>2</sub>)



$\mu_{Air} = 0.010$      $\mu_{Air} =$  \_\_\_\_\_

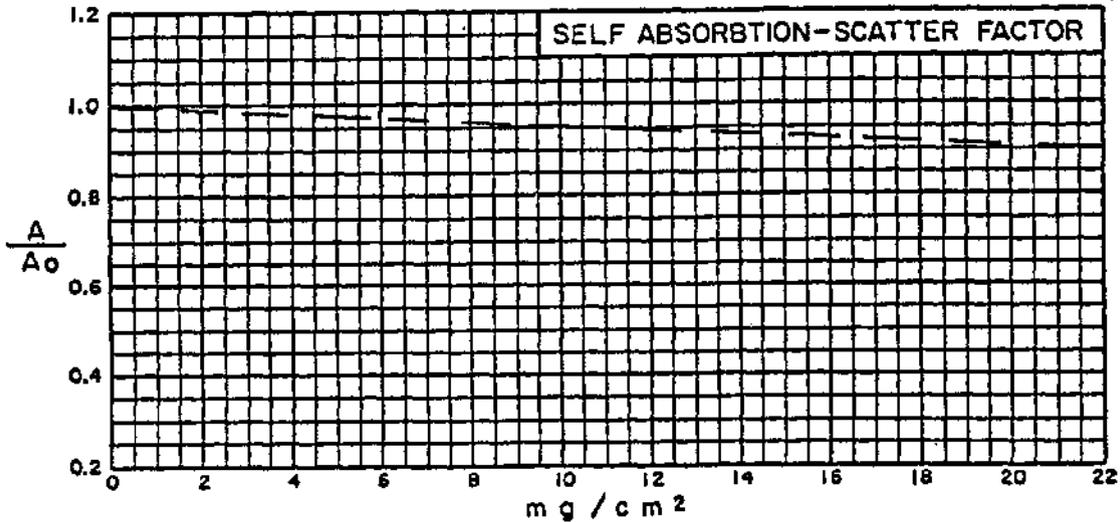
SHELF	AIR & MICA WINDOW FACTORS
1	0.96
2	0.94
3	0.93

SOURCE SPREAD DIAMETER FACTORS

MOUNTING EFFECTIVE AREA	1" S.S. DISH 4.5 cm <sup>2</sup>	1 1/2" S.S. DISH 10 cm <sup>2</sup>	1" GLASS (FLAT) 5.0 cm <sup>2</sup>	138" MILLIPORE 9.6 cm <sup>2</sup>	1 1/2" FILTER 13 cm <sup>2</sup>
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SHELF 2	1.08	0.84	0.88	0.79	0.73
SHELF 3	1.14	0.99	0.93	0.87	0.83

BACK-SCATTER FACTORS

SHELF 1	1.41	1.41	1.25	1.16	1.08
SHELF 2	1.39	1.39	1.20	1.11	1.05
SHELF 3	1.35	1.35	1.18	1.10	1.05



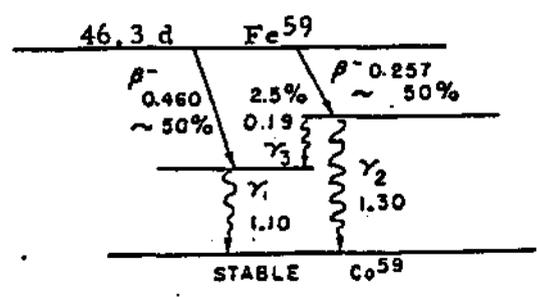
CALCULATION PROCEDURE:  $\frac{C/m \text{ (VOLUME FACTOR)}}{(Geo.) (2.2 \times 10^6) (S.S.) (bs.) (S.S.A.) (A+M.W.) (Yield)} = \mu C / \text{unit}$

Remarks:  $\frac{A}{A_0} = \frac{1}{\mu x} (1 - e^{-\mu x})$

-18-  
ISOTOPE Iron 59

METHOD Ether Extraction

YIELD 28.6 mg = 100 %  
(As Fe<sub>2</sub>O<sub>3</sub>)



$\mu_{Al} = 0.085$      $\mu_{Air} =$  \_\_\_\_\_

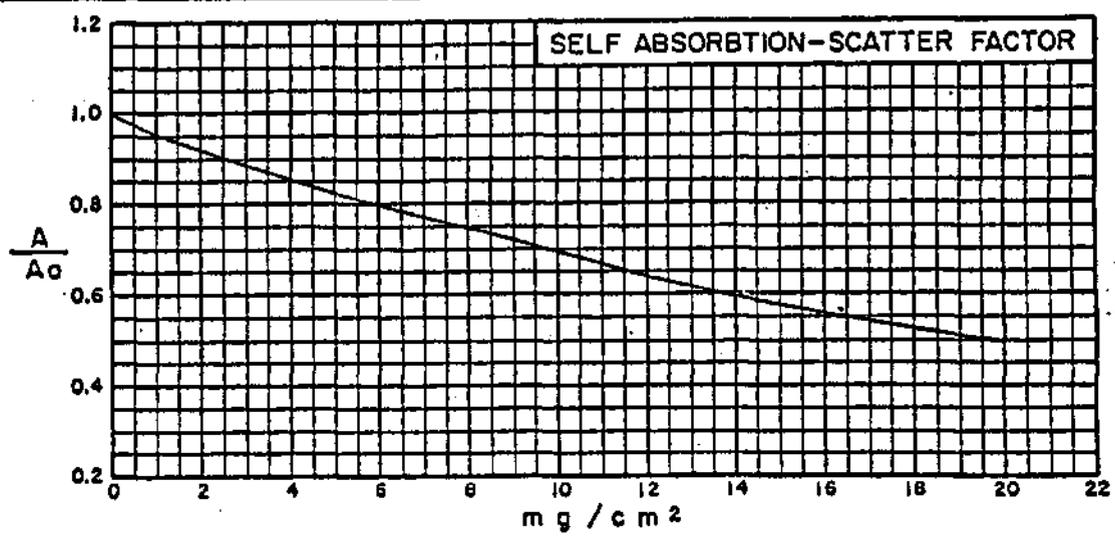
SHELF	AIR & MICA WINDOW FACTORS
1	0.74
2	0.63
3	0.55

SOURCE SPREAD DIAMETER FACTORS

MOUNTING EFFECTIVE AREA	1" S.S. DISH 4.5 cm <sup>2</sup>	1 1/2" S.S. DISH 10 cm <sup>2</sup>	1" GLASS (FLAT) 5.0 cm <sup>2</sup>	1.38" MILLIPORE 9.8 cm <sup>2</sup>	1 1/8" FILTER 13 cm <sup>2</sup>
SHELF 1	0.91	0.53	0.80	0.64	0.53
SHELF 2	0.99	0.75	0.86	0.76	0.69
SHELF 3	1.05	0.89	0.92	0.85	0.80

BACK-SCATTER FACTORS

SHELF 1	1.37	1.37	1.19	1.15	1.12
SHELF 2	1.35	1.35	1.15	1.10	1.08
SHELF 3	1.32	1.32	1.13	1.09	1.07



CALCULATION PROCEDURE:  $\frac{C/m \text{ (VOLUME FACTOR)}}{(Geo.) (2.2 \times 10^5) (S.S.) (bs.) (S.S.A.) (A+M.W.) (Yield)} = \mu C/\text{unit}$

Remarks:  $\frac{A}{A_0} = \frac{1}{\mu x} (1 - e^{-\mu x})$

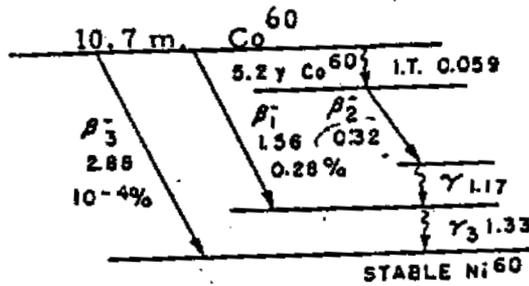
ISOTOPE Cobalt<sup>60</sup>

METHOD<sup>2</sup> Potassium Cobaltinitrite

YIELD 80.2 mg = 100%

(As K<sub>3</sub>Co(NO<sub>2</sub>)<sub>6</sub> · H<sub>2</sub>O)

μ<sub>Air</sub> = 0.088 μ<sub>Air</sub> = 0.06



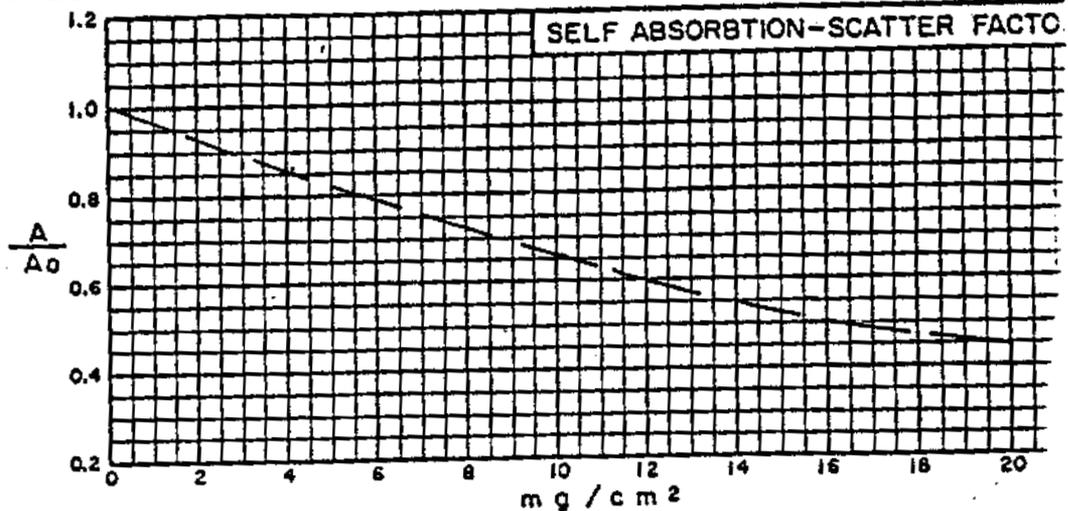
SHELF	AIR & MICA WINDOW FACTORS
1	0.73 (.77)
2	0.62
3	0.52

SOURCE SPREAD DIAMETER FACTORS

MOUNTING EFFECTIVE AREA	1" S.S. DISH 4.5 cm <sup>2</sup>	1 1/2" S.S. DISH 10 cm <sup>2</sup>	1" GLASS (FLAT) 6.0 cm <sup>2</sup>	138" MILLIPORE 9.6 cm <sup>2</sup>	1 1/2" FILTER 13 cm <sup>2</sup>
SHELF 1	0.90	0.53	0.81	0.66	0.56
SHELF 2	0.98	0.75	0.88	0.79	0.73
SHELF 3	1.04	0.89	0.93	0.87	0.83

BACK-SCATTER FACTORS

SHELF 1	1.35	1.35	1.18	1.14	1.11
SHELF 2	1.33	1.33	1.14	1.09	1.07
SHELF 3	1.30	1.30	1.13	1.09	1.07



CALCULATION PROCEDURE:  $\frac{C/m \text{ (VOLUME FACTOR)}}{(Geo)(2.2 \times 10^6)(S.S.)(bs.)(S.S.A.)(A+M.W.)(Yield)} = \mu$

Remarks:  $\frac{A}{A_0} = \frac{1}{\mu x} (1 - e^{-\mu x})$

\*Additional Method

Gamma Spectrometer

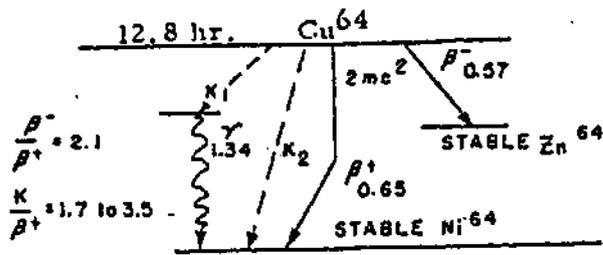
ISOTOPE Copper<sup>64</sup>

METHOD Cuprous Thiocyanate

YIELD 38.2 mg. = 100%

(As Cu SCN)

$\mu_{Al} = 0.032$   $\mu_{Air} =$



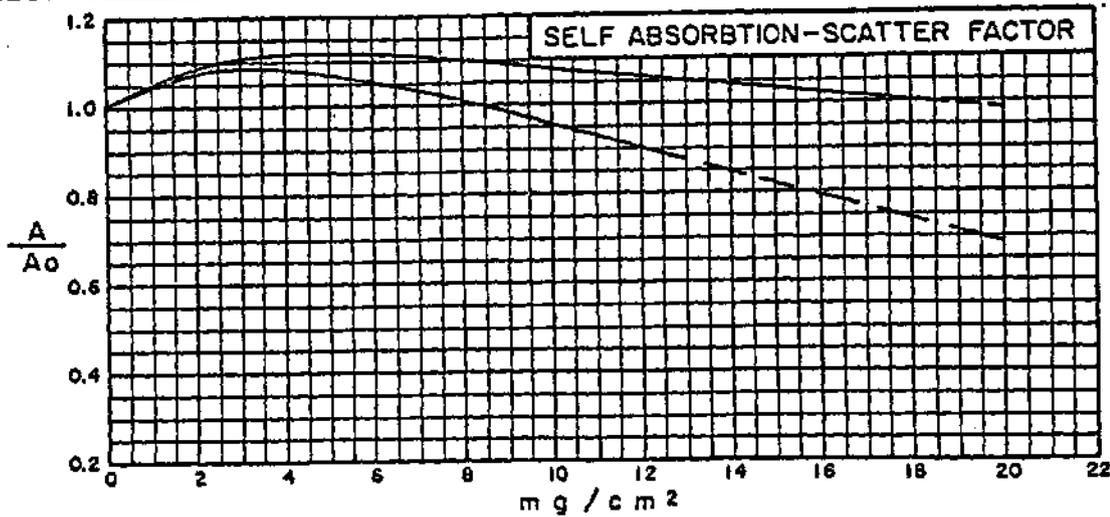
SHELF	AIR B MICA WINDOW FACTORS
1	0.89
2	0.84
3	0.79

SOURCE SPREAD DIAMETER FACTORS

MOUNTING EFFECTIVE AREA	1" S.S. DISH 4.5 cm <sup>2</sup>	1 1/2" S.S. DISH 10 cm <sup>2</sup>	1" GLASS (FLAT) 5.0 cm <sup>2</sup>	1.38" MILLIPORE 9.6 cm <sup>2</sup>	1 1/2" FILTER 13 cm <sup>2</sup>
SHELF 1	0.93	0.55	0.81	0.66	0.56
SHELF 2	1.01	0.78	0.88	0.79	0.73
SHELF 3	1.07	0.92	0.93	0.87	0.83

BACK-SCATTER FACTORS

SHELF 1	1.45	1.45	1.22	1.19	1.11
SHELF 2	1.43	1.43	1.17	1.13	1.07
SHELF 3	1.39	1.39	1.16	1.12	1.07



CALCULATION PROCEDURE:  $\frac{C/m \text{ (VOLUME FACTOR)}}{(\text{Geo.})(2.2 \times 10^6)(\text{S.S.})(\text{bs.})(\text{S.S.A.})(A + \text{M.W.})(\text{Yield})} = \mu C/\text{unit}$

Form: Electroplated Cu on 2.27 cm.<sup>2</sup> St. Stl.

Remarks: Upper curve 1st shelf  
 Lower curve 2nd shelf

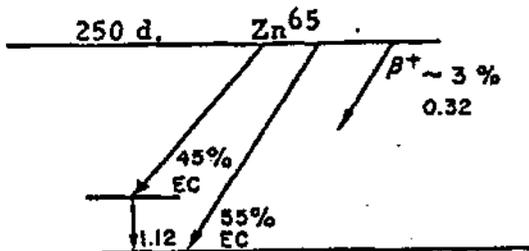
ISOTOPE Zinc<sup>65</sup>

METHOD \* Zinc Sulfide

YIELD 29.8 mg = 100%

(As ZnS)

$\mu_{Al} = 0.088$   $\mu_{Air} =$



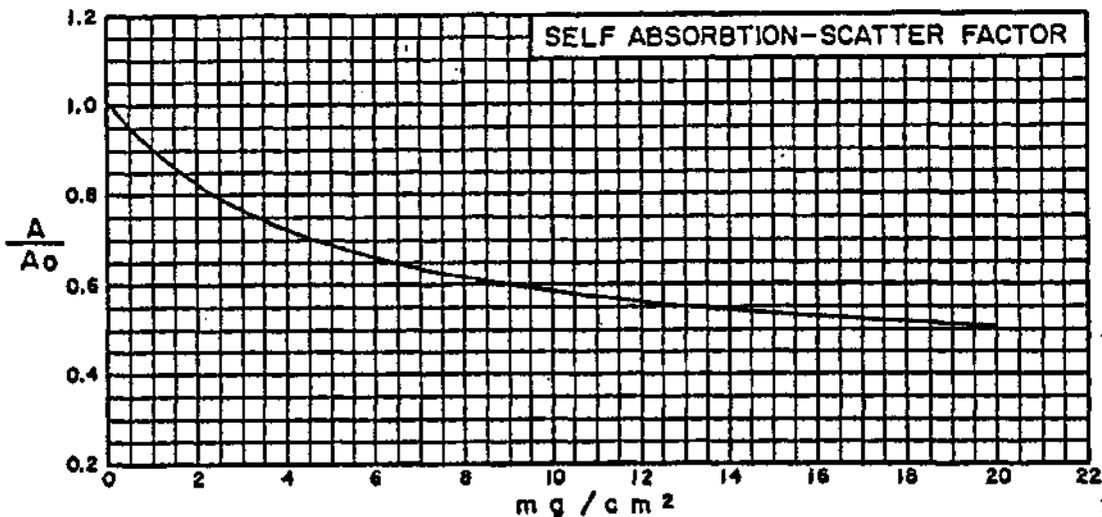
SHELF	AIR B MICA WINDOW FACTORS
1	0.73
2	0.62
3	0.52

SOURCE SPREAD DIAMETER FACTORS

MOUNTING EFFECTIVE AREA	1" S.S. DISH 4.5 cm <sup>2</sup>	1 1/2" S.S. DISH 10 cm <sup>2</sup>	1" GLASS (FLAT) 5.0 cm <sup>2</sup>	1.30" MILLIPORE 9.6 cm <sup>2</sup>	1 1/2" FILTER 13 cm <sup>2</sup>
SHELF 1	0.90	0.53	0.81	0.66	0.56
SHELF 2	0.98	0.75	0.88	0.79	0.73
SHELF 3	1.04	0.89	0.93	0.87	0.83

BACK-SCATTER FACTORS

SHELF 1	1.35	1.35	1.18	1.14	1.11
SHELF 2	1.33	1.33	1.14	1.09	1.07
SHELF 3	1.30	1.30	1.13	1.09	1.07



CALCULATION PROCEDURE:  $\frac{C/m \text{ (VOLUME FACTOR)}}{(\text{Geo})(2.2 \times 10^6)(\text{S.S.})(\text{bs.})(\text{S.S.A})(A+M.W.)(\text{Yield})} = \mu\text{C/unit}$

Remarks: Zn<sup>65</sup> in ZnS on 1" dish - 1st shelf

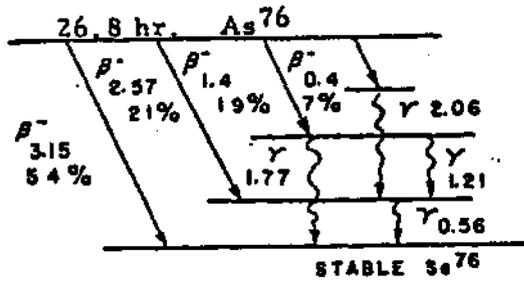
\* Additional Method  
 Gamma Spectrometer

ISOTOPE Arsenic 76

METHOD Arsenic Sulfide

YIELD 32.8 mg. = 100%  
(As As<sub>2</sub>S<sub>3</sub>)

$\mu_{Al} = 0.007$   $\mu_{Air} =$



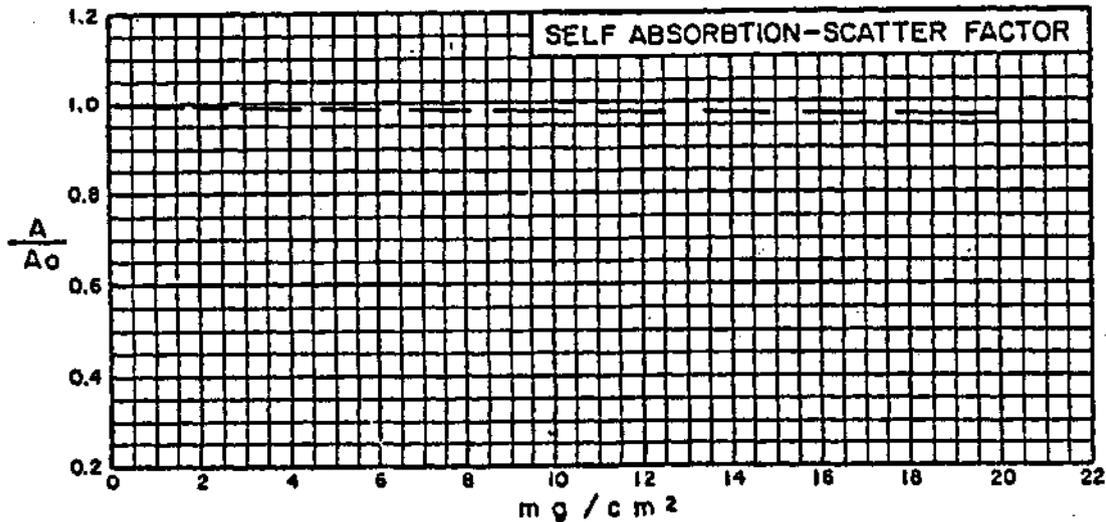
SHELF	AIR & MICA WINDOW FACTORS
1	0.98
2	0.96
3	0.95

SOURCE SPREAD DIAMETER FACTORS

MOUNTING EFFECTIVE AREA	1" S.S. DISH 4.8 cm <sup>2</sup>	1 1/2" S.S. DISH 10 cm <sup>2</sup>	1" GLASS (FLAT) 5.0 cm <sup>2</sup>	1.38" MILLIPORE 9.6 cm <sup>2</sup>	1 1/2" FILTER 13 cm <sup>2</sup>
SHELF 1	1.03	0.61	0.81	0.66	0.56
SHELF 2	1.12	0.87	0.88	0.79	0.73
SHELF 3	1.18	1.02	0.93	0.87	0.83

BACK-SCATTER FACTORS

SHELF 1	1.38	1.38	1.27	1.14	1.07
SHELF 2	1.36	1.36	1.21	1.09	1.05
SHELF 3	1.33	1.33	1.19	1.09	1.04



CALCULATION PROCEDURE:  $\frac{C/m \text{ (VOLUME FACTOR)}}{(\text{Geo.})(2.2 \times 10^6)(\text{S.S.})(\text{bs.})(\text{S.S.A.})(A \rightarrow \text{M.W.})(\text{Yield})} = \mu C/\text{unit}$

Remarks:  $\frac{A}{A_0} = \frac{1}{\mu x} (1 - e^{-\mu x})$

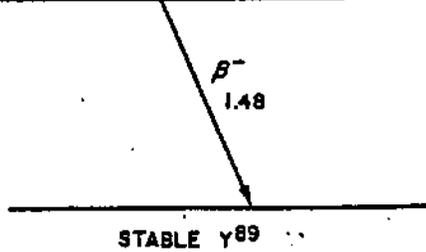
ISOTOPE Strontium<sup>89</sup>

METHOD Fuming Nitric Acid

YIELD <sup>35.7</sup> 44.2 mg = 100%  
(As SrC<sub>2</sub>O<sub>4</sub>)

54 d. Sr<sup>89</sup>

μ<sub>Air</sub> = 0.0072 μ<sub>Air</sub> =



SHELF	AIR & MICA WINDOW FACTORS
1	0.97
2	0.96
3	0.95

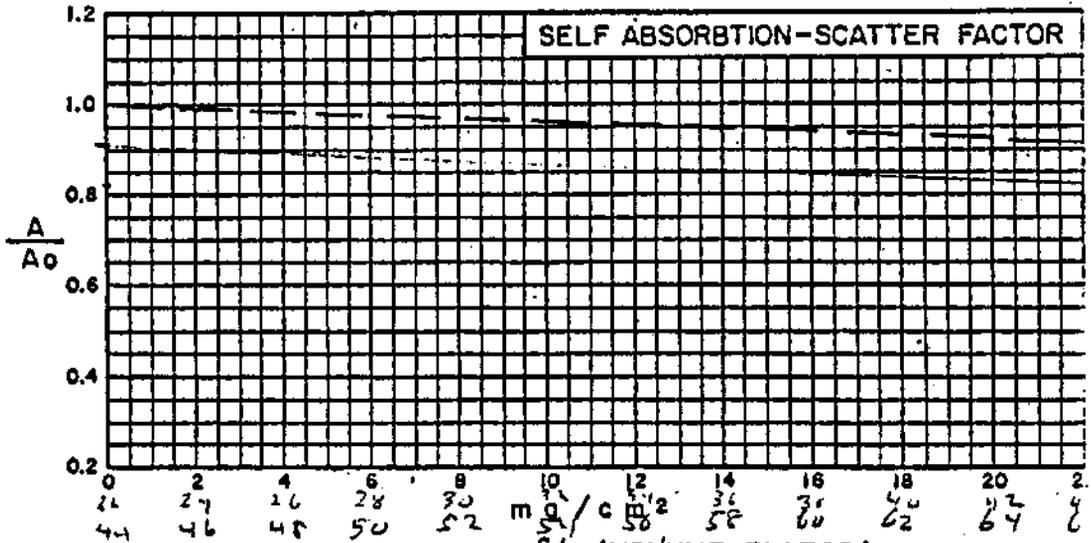
3.111

SOURCE SPREAD DIAMETER FACTORS

MOUNTING EFFECTIVE AREA	1" S.S. DISH 4.5 cm <sup>2</sup>	1 1/2" S.S. DISH 10 cm <sup>2</sup>	1" GLASS (FLAT) 5.0 cm <sup>2</sup>	138" MILLIPORE 9.6 cm <sup>2</sup>	1 1/2" FILTER 13 cm <sup>2</sup>
SHELF 1	0.99	0.59	0.81	0.66	0.56
SHELF 2	1.08	0.84	0.88	0.79	0.73
SHELF 3	1.14	0.99	0.93	0.87	0.83

BACK-SCATTER FACTORS

SHELF 1	1.44	1.44	1.26	1.17	1.08
SHELF 2	1.42	1.42	1.21	1.11	1.05
SHELF 3	1.38	1.38	1.18	1.10	1.05



CALCULATION PROCEDURE:  $\frac{A}{A_0} = \frac{1}{\mu x} (1 - e^{-\mu x})$   
 (Geo.) (2.2 x 10<sup>6</sup>) (S.S.) (bs.) (S.S.A.) (A + M.W.) (Yield) = μC/unit

Remarks:  $\frac{A}{A_0} = \frac{1}{\mu x} (1 - e^{-\mu x})$

HW-18258-APP

-24-

As SrCO<sub>3</sub> 44.2 mg. = 100%  
33.7 mg. = 100% carbonate

ISOTOPE Strontium<sup>90</sup>

METHOD Fuming Nitric Acid

YIELD 44.2 mg. = 100%

(As SrC<sub>2</sub>O<sub>4</sub>)

$\mu_{Al} = 0.034$   $\mu_{Air} =$

19.9 yr. Sr<sup>90</sup>

$\beta^-$  { 0.53 TO 0.61 }

62 hr. Y<sup>90</sup>

3,654

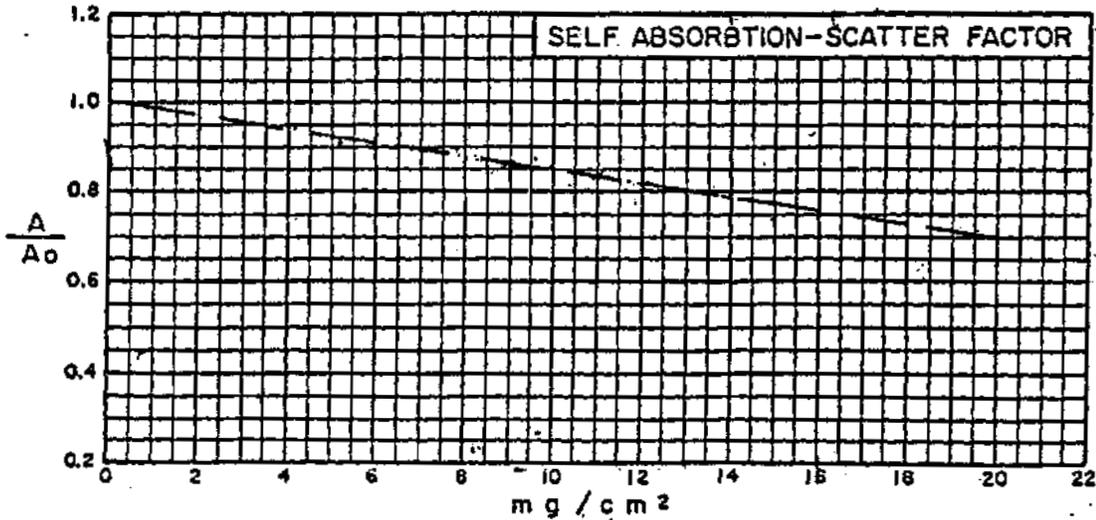
SHELF	AIR & MICA WINDOW FACTORS
1	0.88 0.96
2	0.83 0.89
3	0.78 0.21

SOURCE SPREAD DIAMETER FACTORS

MOUNTING EFFECTIVE AREA	1" S.S. DISH 4.5 cm <sup>2</sup>	1 1/2" S.S. DISH 10 cm <sup>2</sup>	1" GLASS (FLAT) 5.0 cm <sup>2</sup>	130" MILLIPORE 9.6 cm <sup>2</sup>	1 1/2" FILTER 13 cm <sup>2</sup>
SHELF 1	0.94	0.55	0.81	0.66	0.56
SHELF 2	1.02	0.78	0.88	0.79	0.73
SHELF 3	1.08	0.92	0.93	0.87	0.83

BACK-SCATTER FACTORS

SHELF 1	1.45	1.45	1.22	1.19	1.11
SHELF 2	1.43	1.43	1.17	1.13	1.07
SHELF 3	1.39	1.39	1.16	1.12	1.07



CALCULATION PROCEDURE:  $\frac{C/m \text{ (VOLUME FACTOR)}}{(Geo.) (2.2 \times 10^6) (S.S.) (bs.) (S.S.A.) (A+M.W.) (Yield)} = \mu C / \text{unit}$

Remarks:  $\frac{A}{A_0} = \frac{1}{\mu x} (1 - e^{-\mu x})$

$T_{mJ} C_{geo} = 1.339 \text{ shelf} \times 2$   
2/4/63 K112 sl '65

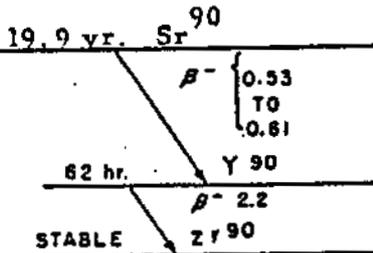
ISOTOPE Strontium<sup>90</sup> - Yttrium<sup>90</sup>

METHOD Fuming Nitric Acid

YIELD 44.2 mg. = 100%

(As Sr C<sub>2</sub> O<sub>4</sub>)

$\mu_{Al} = 0.019$   $\mu_{Air} =$



3.28

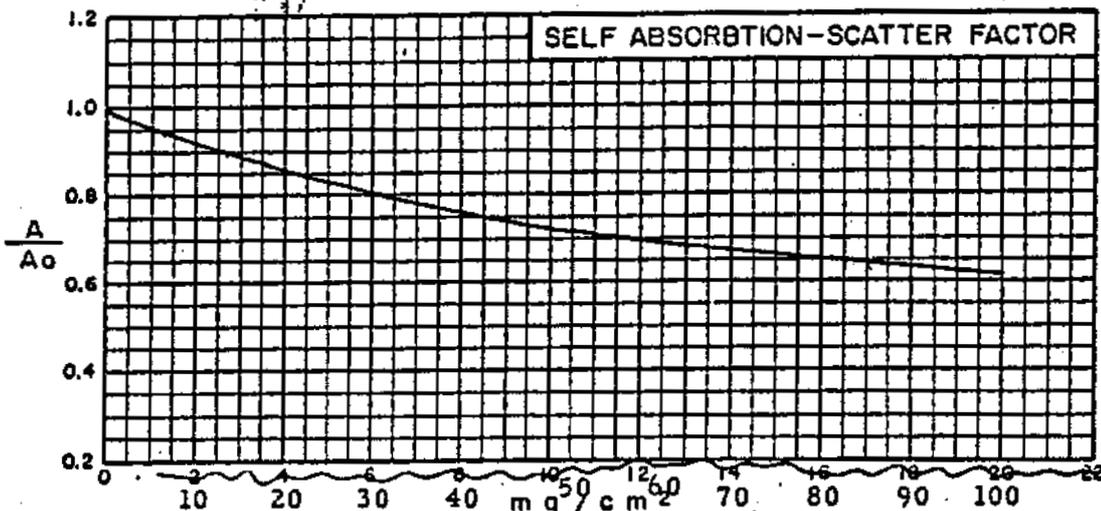
SHELF	AIR & MICA WINDOW FACTORS
1	0.94 (.96)
2	0.90 (.92)
3	0.87 (.89)
4	(.85)

SOURCE SPREAD DIAMETER FACTORS

MOUNTING EFFECTIVE AREA	1" S.S. DISH 4.5 cm <sup>2</sup>	1 1/2" S.S. DISH 10 cm <sup>2</sup>	1" GLASS (FLAT) 5.0 cm <sup>2</sup>	1.38" MILLIPORE 9.6 cm <sup>2</sup>	1 1/2" FILTER 13 cm <sup>2</sup>
SHELF 1	0.98	0.58	0.81	0.66	0.56
SHELF 2	1.07	0.83	0.88	0.79	0.73
SHELF 3	1.13	0.97	0.93	0.87	0.83

BACK-SCATTER FACTORS

SHELF 1	1.43	1.43	1.24	1.17	1.09
SHELF 2	1.41	1.41	1.19	1.11	1.06
SHELF 3	1.37	1.37	1.17	1.11	1.06



CALCULATION PROCEDURE:  $\frac{C/m \text{ (VOLUME FACTOR)}}{(\text{Geo.})(2.2 \times 10^6)(\text{S.S.})(\text{bs.})(\text{S.S.A.})(A+M.W.)(\text{Yield})} = \mu\text{C/unit}$

Remarks: Sr<sup>90</sup> - Y<sup>90</sup> in river water salts on 1" dish - 1st shelf

*not of 1st shelf  
100% yield/act.*

*1.43 x 10<sup>6</sup> / (S.S.A.) (Y)*

ISOTOPE Yttrium 90

METHOD Yttrium Fluoride

YIELD  $\frac{25.4 \text{ mg}}{50.8 \text{ mg}} = 100\%$

(As  $Y_2O_3$ )

$\mu_{Al} = 0.0038 \mu_{Air} =$

62 hr.  $Y^{90}$

$\beta^-$   
2.2

STABLE  $Zr^{90}$

SHELF	AIR & MICA WINDOW FACTORS
1	0.99
2	0.98
3	0.97

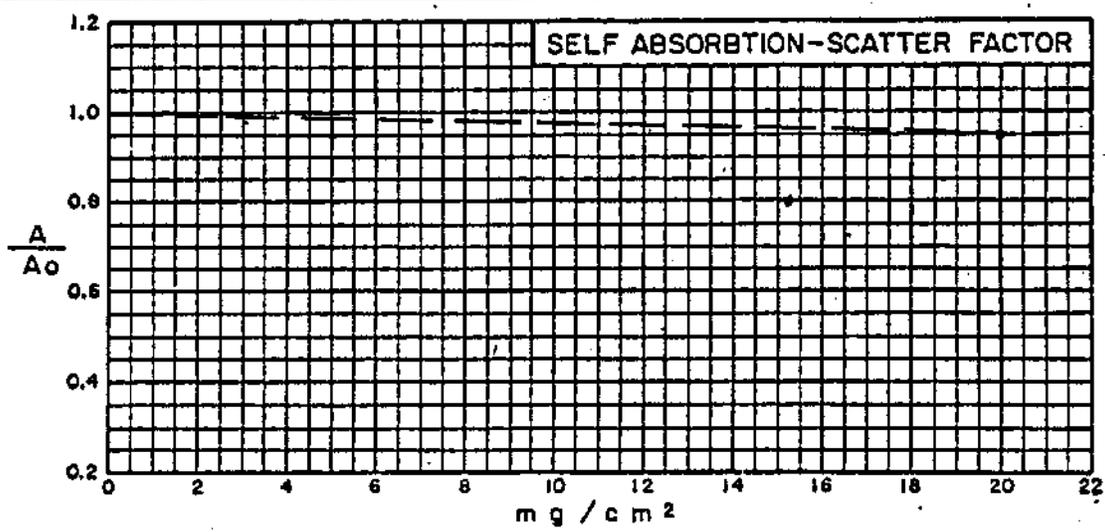
3.033

SOURCE SPREAD DIAMETER FACTORS

MOUNTING EFFECTIVE AREA	1" S.S. DISH 4.5 cm <sup>2</sup>	1 1/2" S.S. DISH 10 cm <sup>2</sup>	1" GLASS (FLAT) 5.0 cm <sup>2</sup>	1.38" MILLIPORE 9.8 cm <sup>2</sup>	1 1/2" FILTER 13 cm <sup>2</sup>
SHELF 1	1.02	0.61	0.81	0.66	0.56
SHELF 2	1.11	0.87	0.88	0.79	0.73
SHELF 3	1.17	1.02	0.93	0.87	0.83

BACK-SCATTER FACTORS

SHELF 1	1.40	1.40	1.26	1.14	1.06
SHELF 2	1.38	1.38	1.21	1.09	1.04
SHELF 3	1.34	1.34	1.18	1.09	1.04



CALCULATION PROCEDURE:  $\frac{C/m \text{ (VOLUME FACTOR)}}{(\text{Geo.})(2.2 \times 10^5)(\text{S.S.})(\text{bs.})(\text{S.S.} \times A + \text{M.W.})(\text{Yield})} = \mu C/\text{unit}$

Remarks:  $\frac{A}{A_0} = \frac{1}{\mu x} (1 - e^{-\mu x})$

ISOTOPE Yttrium<sup>91</sup>

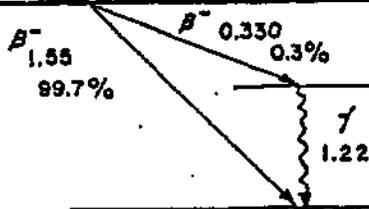
METHOD Yttrium Fluoride

YIELD  $\frac{50.8 \text{ mg}}{50.4 \text{ mg}} = 100\%$

(As Y<sub>2</sub>O<sub>3</sub>)

$\mu_{\text{Al}} = 0.0067$   $\mu_{\text{Air}} =$

<sup>91</sup>Y 58.5 ± 1.0 day



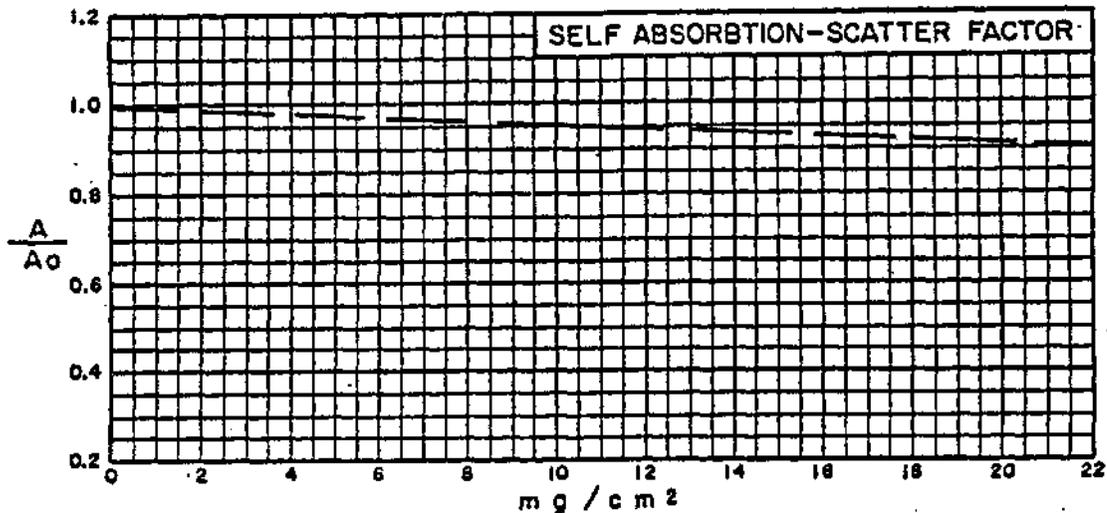
SHELF	AIR B MICA WINDOW FACTORS
1	0.98
2	0.96
3	0.95

SOURCE SPREAD DIAMETER FACTORS

MOUNTING EFFECTIVE AREA	1" S.S. DISH 4.5 cm <sup>2</sup>	1 1/2" S.S. DISH 10 cm <sup>2</sup>	1" GLASS (FLAT) 5.0 cm <sup>2</sup>	1.38" MILLIPORE 9.6 cm <sup>2</sup>	1 1/2" FILTER 13 cm <sup>2</sup>
SHELF 1	1.07	0.64	0.81	0.66	0.56
SHELF 2	1.17	0.91	0.88	0.79	0.73
SHELF 3	1.23	1.08	0.93	0.87	0.83

BACK-SCATTER FACTORS

SHELF 1	1.44	1.44	1.26	1.16	1.09
SHELF 2	1.42	1.42	1.21	1.11	1.06
SHELF 3	1.38	1.38	1.18	1.10	1.05



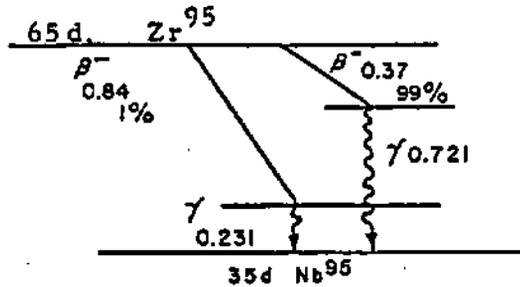
CALCULATION PROCEDURE:  $\frac{C/m \text{ (VOLUME FACTOR)}}{(\text{Geo.})(2.2 \times 10^6)(\text{S.S.})(\text{bs.})(\text{S.S.A.})(A + \text{M.W.})(\text{Yield})} = \mu\text{C/unit}$

Remarks:  $\frac{A}{A_0} = \frac{1}{\mu x} (1 - e^{-\mu x})$

ISOTOPE Zirconium<sup>95</sup>

METHOD\* Barium Fluozirconate

YIELD 27.0 mg = 100%  
(As ZrO<sub>2</sub>)



$\mu_{Al} = \frac{8.032}{0.217}$   $\mu_{Air} =$

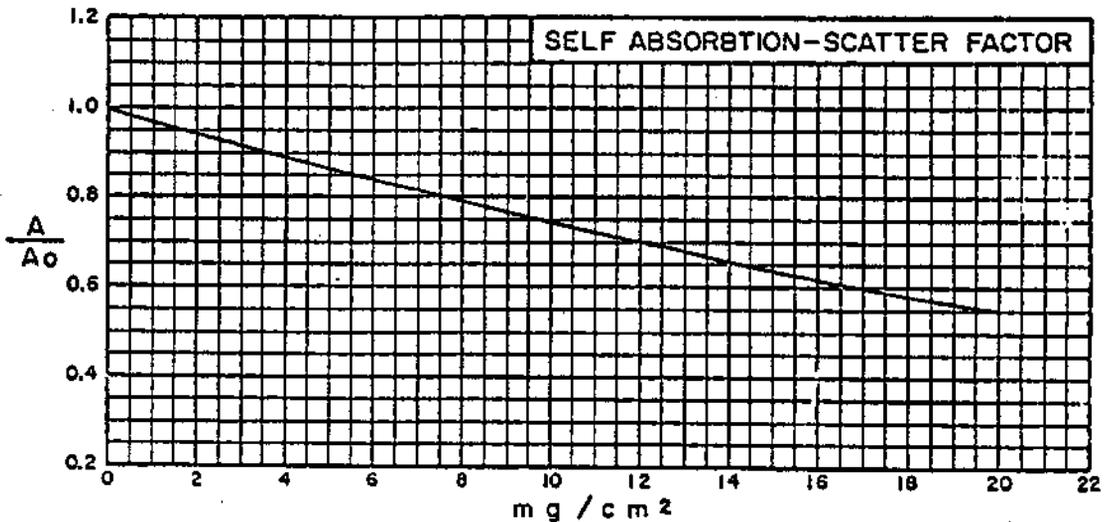
SHELF	AIR & MICA WINDOW FACTORS
1	0.78
2	0.69
3	0.60

SOURCE SPREAD DIAMETER FACTORS

MOUNTING EFFECTIVE AREA	1" S.S. DISH 4.5 cm <sup>2</sup>	1 1/2" S.S. DISH 10 cm <sup>2</sup>	1" GLASS (FLAT) 5.0 cm <sup>2</sup>	1.38" MILLIPORE 9.6 cm <sup>2</sup>	1 1/2" FILTER 13 cm <sup>2</sup>
SHELF 1	0.91	0.53	0.81	0.66	0.56
SHELF 2	0.99	0.75	0.88	0.79	0.73
SHELF 3	1.05	0.89	0.93	0.87	0.83

BACK-SCATTER FACTORS

SHELF 1	1.38	1.38	1.19	1.16	1.10
SHELF 2	1.36	1.36	1.15	1.11	1.07
SHELF 3	1.33	1.33	1.13	1.10	1.06



CALCULATION PROCEDURE:  $\frac{C/m \text{ (VOLUME FACTOR)}}{(\text{Geo.}) \times (2.2 \times 10^6) \times (\text{S.S.}) \times (\text{bs.}) \times (\text{S.S.A.}) \times (\text{A} + \text{M.W.}) \times (\text{Yield})} = \mu\text{C/unit}$

\*Additional Methods  
Zirconium Phenylarsonate

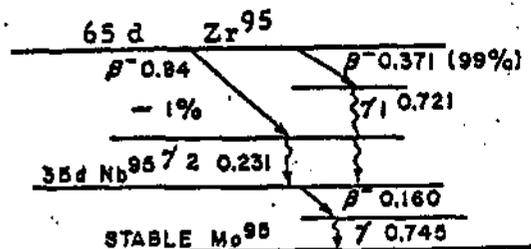
Mounting  
1" S S - dish

Yield  
~ 90 mg = 100%

ISOTOPE Zirconium<sup>95</sup> - Niobium<sup>95</sup>

METHOD Spike - Direct Plate

YIELD



$\mu_{Al} = 0.15$      $\mu_{Air} =$

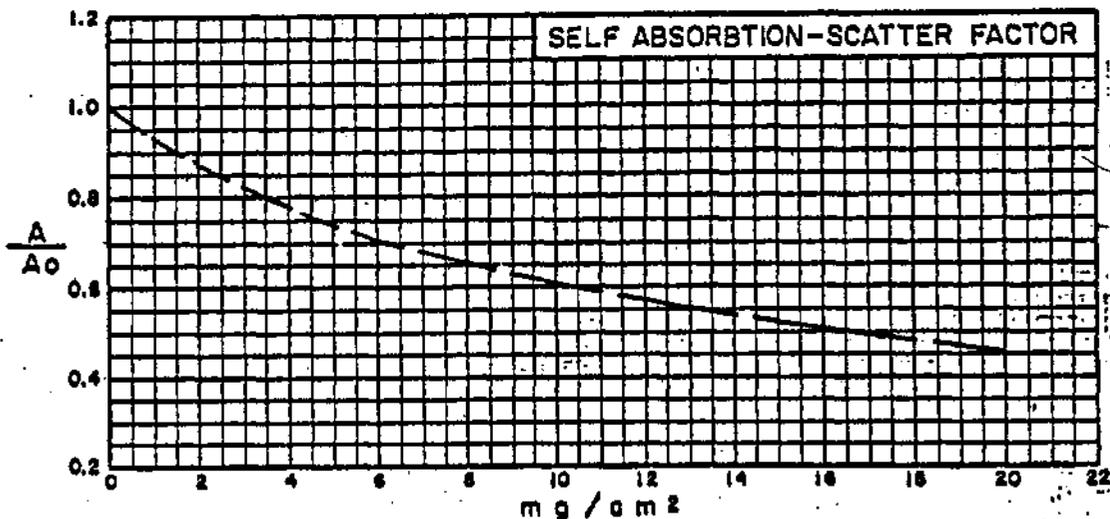
SHELF	AIR & MICA WINDOW FACTORS
1	0.58
2	0.46
3	0.37

SOURCE SPREAD DIAMETER FACTORS

MOUNTING EFFECTIVE AREA	1" S.S. DISH 4.5 cm <sup>2</sup>	1 1/2" S.S. DISH 10 cm <sup>2</sup>	1" GLASS (FLAT) 6.0 cm <sup>2</sup>	138" MILLIPORE 9.8 cm <sup>2</sup>	1 1/2" FILTER 13 cm <sup>2</sup>
SHELF 1	0.89	0.52	0.80	0.64	0.53
SHELF 2	0.97	0.73	0.86	0.76	0.69
SHELF 3	1.02	0.87	0.92	0.85	0.80

BACK-SCATTER FACTORS

SHELF 1	1.30	1.30	1.16	1.12	1.08
SHELF 2	1.29	1.29	1.12	1.08	1.06
SHELF 3	1.27	1.27	1.11	1.07	1.05



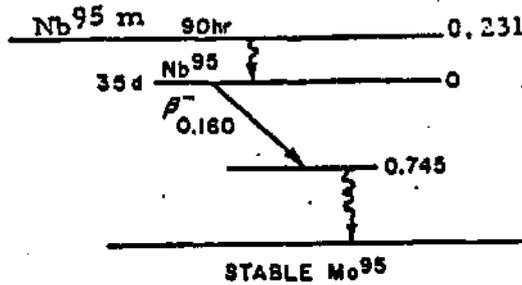
CALCULATION PROCEDURE:  $\frac{C/m \text{ (VOLUME FACTOR)}}{(\text{Geo.})(2.2 \times 10^6)(\text{S.S.})(\text{b.s.})(\text{S.S.A.})(A + \text{M.W.})(\text{Yield})} \times \mu C/\text{unit}$

Remarks:  $\frac{A}{A_0} = \frac{1}{\mu x} (1 - e^{-\mu x})$

ISOTOPE Niobium<sup>95</sup>

METHOD Niobic Oxide

YIELD 28.6 mg = 100%  
(As Nb<sub>2</sub>O<sub>5</sub>)



μ<sub>Al</sub> = 0.27 μ<sub>Air</sub> =

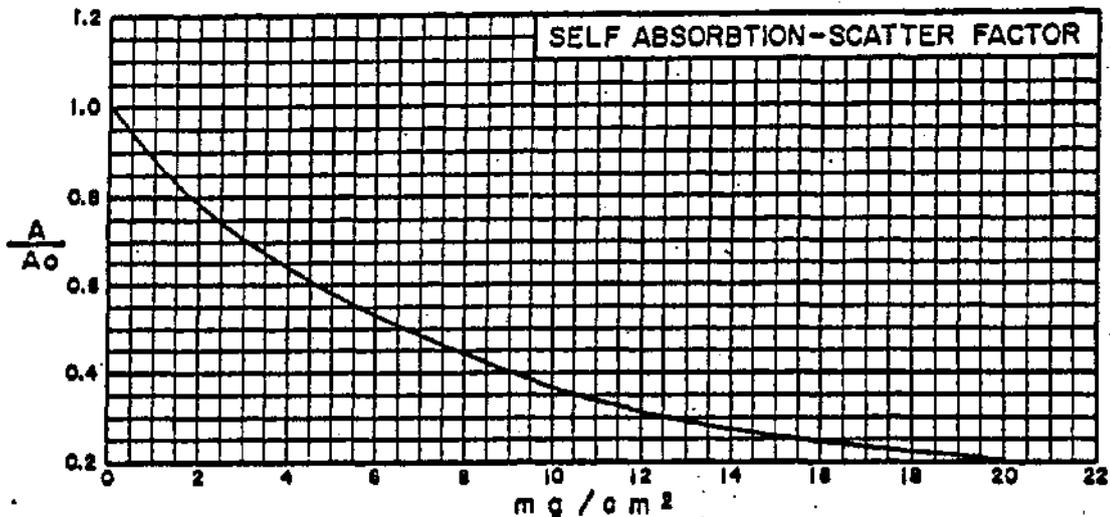
SHELF	AIR & MICA WINDOW FACTORS
1	0.38
2	0.23
3	0.14

SOURCE SPREAD DIAMETER FACTORS

MOUNTING EFFECTIVE AREA	1" S.S. DISH 4.5 cm <sup>2</sup>	1 1/2" S.S. DISH 10 cm <sup>2</sup>	1" GLASS (FLAT) 8.0 cm <sup>2</sup>	1.38" MILLIPORE 9.6 cm <sup>2</sup>	1 1/2" FILTER 13 cm <sup>2</sup>
SHELF 1	0.86	0.50	0.78	0.61	0.50
SHELF 2	0.94	0.71	0.84	0.72	0.65
SHELF 3	0.99	0.84	0.90	0.82	0.77

BACK-SCATTER FACTORS

SHELF 1	1.23	1.23	1.12	1.07	1.06
SHELF 2	1.22	1.22	1.09	1.05	1.04
SHELF 3	1.20	1.20	1.09	1.04	1.04

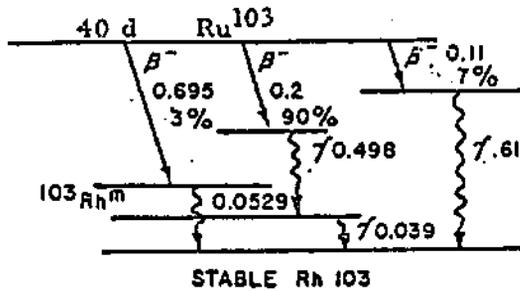


CALCULATION PROCEDURE:  $\frac{C/m \text{ (VOLUME FACTOR)}}{(Geo.) (2.2 \times 10^6) (S.S.) (bs.) (S.S.A.) (A \cdot M.W.) (Yield)} = \mu C/unit$

ISOTOPE Ruthenium 103

METHOD\* Distillation

YIELD 100% = 28.0 mg.  
(As RuO<sub>2</sub> standardized)



$\mu_{Al} = 0.195$      $\mu_{Air} =$  \_\_\_\_\_

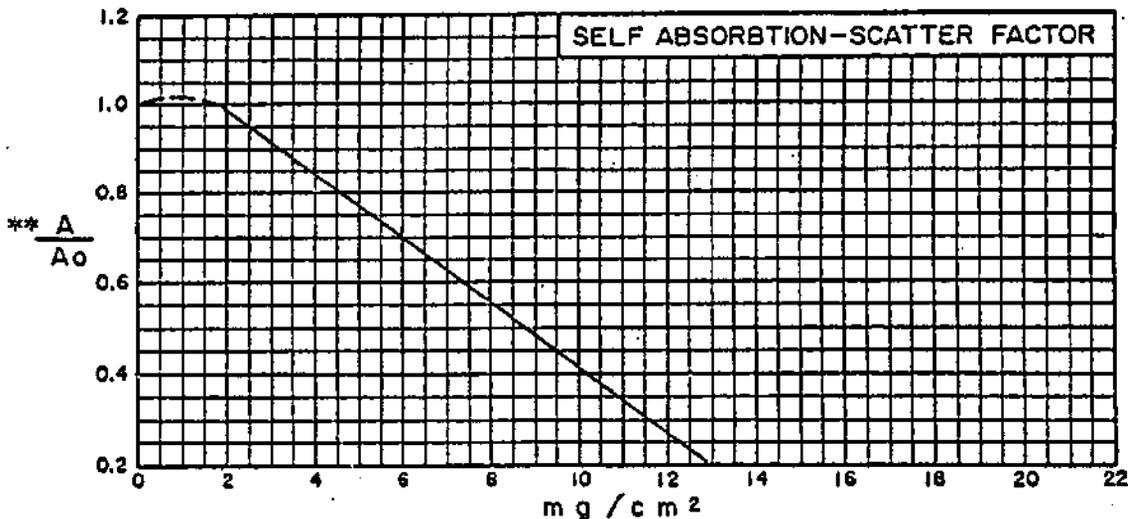
SHELF	AIR B MICA WINDOW FACTORS
1	0.50
2	0.35
3	0.25

SOURCE SPREAD DIAMETER FACTORS

MOUNTING EFFECTIVE AREA	1" S.S. DISH 4.5 cm <sup>2</sup>	1 1/2" S.S. DISH 10 cm <sup>2</sup>	1" GLASS (FLAT) 5.0 cm <sup>2</sup>	1.38" MILLIPORE 9.6 cm <sup>2</sup>	1 1/2" FILTER 13 cm <sup>2</sup>
SHELF 1	0.87	0.51	0.78	0.61	0.50
SHELF 2	0.95	0.72	0.84	0.72	0.65
SHELF 3	1.00	0.86	0.90	0.82	0.77

BACK-SCATTER FACTORS

SHELF 1	1.27	1.27	1.14	1.09	1.07
SHELF 2	1.26	1.26	1.11	1.06	1.05
SHELF 3	1.23	1.23	1.10	1.05	1.04



CALCULATION PROCEDURE:  $\frac{C/m \text{ (VOLUME FACTOR)}}{(\text{Geo})(2.2 \times 10^6)(\text{S.S.})(\text{bs.})(\text{S.S.A.})(\text{A} + \text{M.W.})(\text{Yield})} = \mu\text{C/unit}$

\* Additional Methods

Reduction  
Carrier-free (CCl<sub>4</sub>)

Mounting

1" S S dish  
1" S S dish

Yield

100% = 20 mg.  
100%

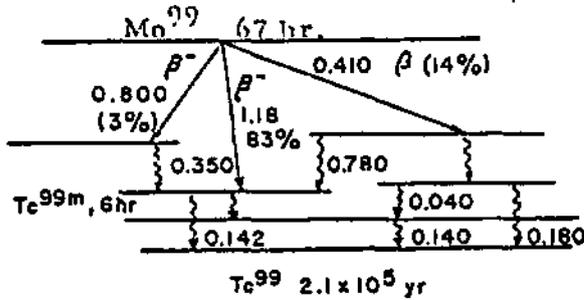
\*\* Remarks: Ru<sup>103</sup> as RuO(OH)<sub>2</sub> on std. 1" dishes (4.5 CM<sup>2</sup>) on shelf one.

ISOTOPE Molybdenum<sup>99</sup>

METHOD  $\alpha$ -Nephthoxime

YIELD 30.0 mg = 100%  
(As MoO<sub>3</sub>)

$\mu_{Al} =$  \_\_\_\_\_  $\mu_{Air} =$  \_\_\_\_\_



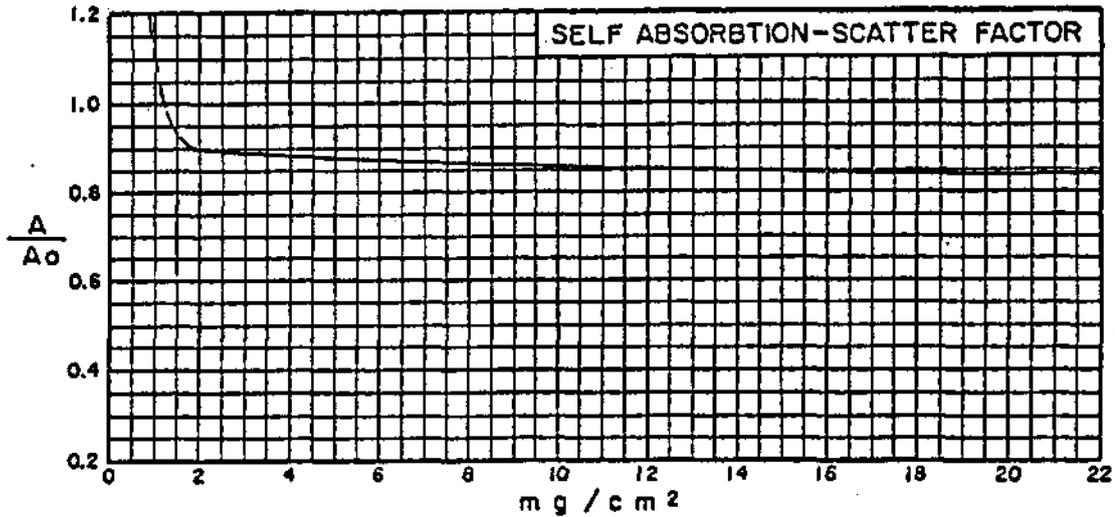
SHELF	AIR & MICA WINDOW FACTORS
1	0.96
2	0.91
3	0.88

SOURCE SPREAD DIAMETER FACTORS

MOUNTING EFFECTIVE AREA	1" S.S. DISH 4.5 cm <sup>2</sup>	1 1/2" S.S. DISH 10 cm <sup>2</sup>	1" GLASS (FLAT) 5.0 cm <sup>2</sup>	138" MILLIPORE 9.6 cm <sup>2</sup>	1 1/2" FILTER 13 cm <sup>2</sup>
SHELF 1	0.97	0.57	0.81	0.66	0.56
SHELF 2	1.06	0.81	0.88	0.79	0.73
SHELF 3	1.12	0.96	0.93	0.87	0.83

BACK-SCATTER FACTORS

SHELF 1	1.44	1.44	1.24	1.18	1.09
SHELF 2	1.42	1.42	1.19	1.12	1.06
SHELF 3	1.38	1.38	1.17	1.11	1.05



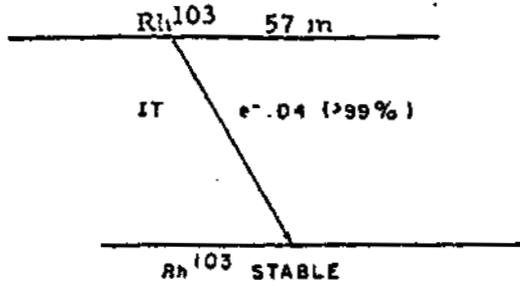
CALCULATION PROCEDURE:  $\frac{C/m \text{ (VOLUME FACTOR)}}{(\text{Geo.})(2.2 \times 10^6)(\text{S.S.})(\text{bs.})(\text{S.S.A})(A+M.W.)(\text{Yield})} = \mu\text{C/unit}$

Remarks: Mo O<sub>3</sub> on 1" dishes

ISOTOPE Rhodium 103

METHOD \_\_\_\_\_

YIELD \_\_\_\_\_



$\mu_{Air} =$  \_\_\_\_\_  $\mu_{Air} =$  \_\_\_\_\_

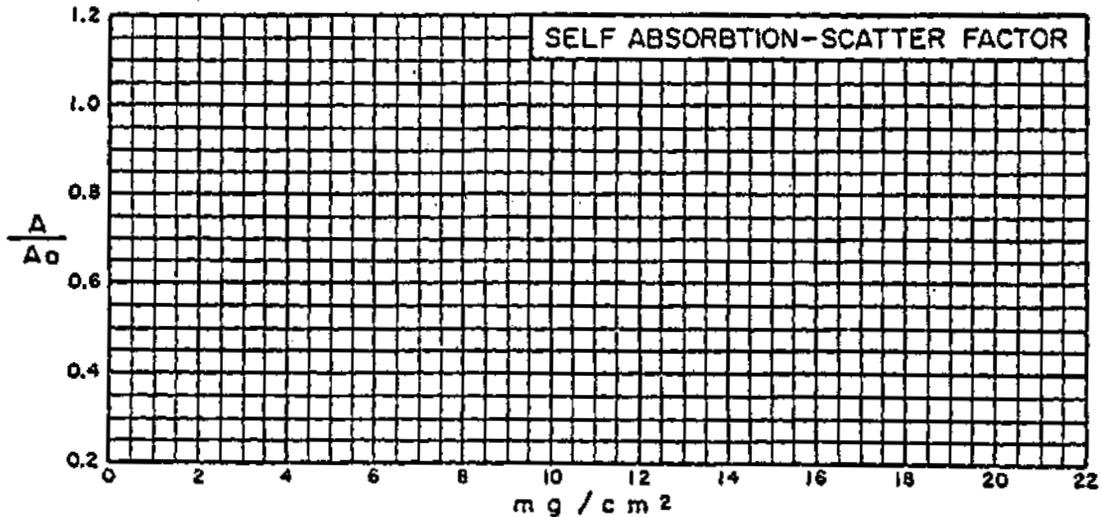
SHELF	AIR & MICA WINDOW FACTORS
1	
2	
3	

SOURCE SPREAD DIAMETER FACTORS

MOUNTING EFFECTIVE AREA	1" S.S. DISH 4.5 cm <sup>2</sup>	1 1/2" S.S. DISH 10 cm <sup>2</sup>	1" GLASS (FLAT) 5.0 cm <sup>2</sup>	1.38" MILLIPORE 9.6 cm <sup>2</sup>	1 1/2" FILTER 13 cm <sup>2</sup>
SHELF 1					
SHELF 2					
SHELF 3					

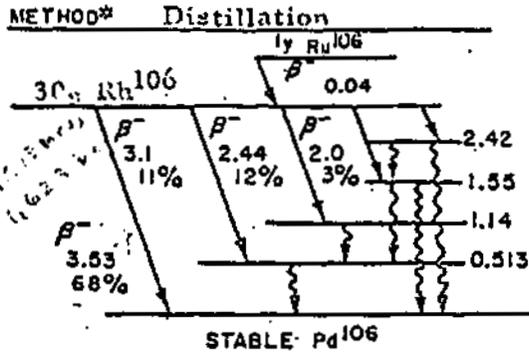
BACK-SCATTER FACTORS

SHELF 1				
SHELF 2				
SHELF 3				



CALCULATION PROCEDURE:  $\frac{C/m \text{ (VOLUME FACTOR)}}{(\text{Geo.})(2.2 \times 10^6)(\text{S.S.})(\text{bs.})(\text{S.S.A.})(\text{A}+\text{M.W.})(\text{Yield})} = \mu\text{C/unit}$

ISOTOPE Rhodium<sup>106</sup> (Ruthenium<sup>106</sup>)



YIELD 28.0 mg = 100%  
 (As RuO<sub>2</sub> standardized)  
 $\mu_{Al} = 0.002$   $\mu_{Air} =$

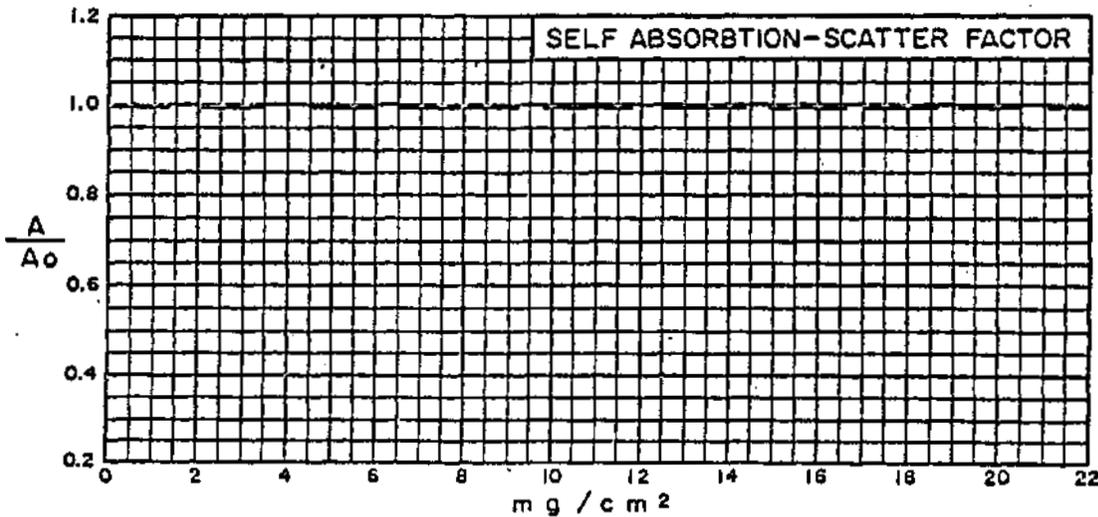
SHELF	AIR & MICA WINDOW FACTORS
1	0.99
2	0.99
3	0.99

SOURCE SPREAD DIAMETER FACTORS

MOUNTING EFFECTIVE AREA	1" S.S. DISH 4.5 cm <sup>2</sup>	1 1/2" S.S. DISH 10 cm <sup>2</sup>	1" GLASS (FLAT) 5.0 cm <sup>2</sup>	1.38" MILLIPORE 9.6 cm <sup>2</sup>	1 1/2" FILTER 13 cm <sup>2</sup>
SHELF 1	0.98	0.59	0.81	0.66	0.56
SHELF 2	1.07	0.84	0.88	0.79	0.73
SHELF 3	1.13	0.99	0.93	0.87	0.83

BACK-SCATTER FACTORS

SHELF 1	1.33	1.33	1.26	1.12	1.08
SHELF 2	1.31	1.31	1.21	1.08	1.05
SHELF 3	1.28	1.28	1.18	1.07	1.05



CALCULATION PROCEDURE:  $\frac{C/m \text{ (VOLUME FACTOR)}}{(\text{Geo.})(2.2 \times 10^6)(\text{S.S.})(\text{bs.})(\text{S.S.})(A)(A+M.W.)(\text{Yield})} = \mu\text{C/unit}$

Remarks:  $\frac{A}{A_0} = \frac{1}{\mu x} (1 - e^{-\mu x})$

\* Additional Methods  
 Reduction  
 Carrier-free (CCl<sub>4</sub>)

Mounting  
 1" S S dish  
 1" S S dish  
 Yield  
 100% = 20 mg.  
 100%

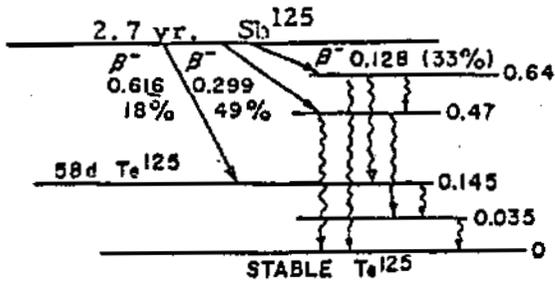
ISOTOPE Antimony<sup>125</sup>

METHOD Antimony Sulfide

YIELD 27.9 mg = 100%

(As Sb<sub>2</sub>S<sub>3</sub>)

$\mu_{Al} = 0.15$   $\mu_{Air} =$



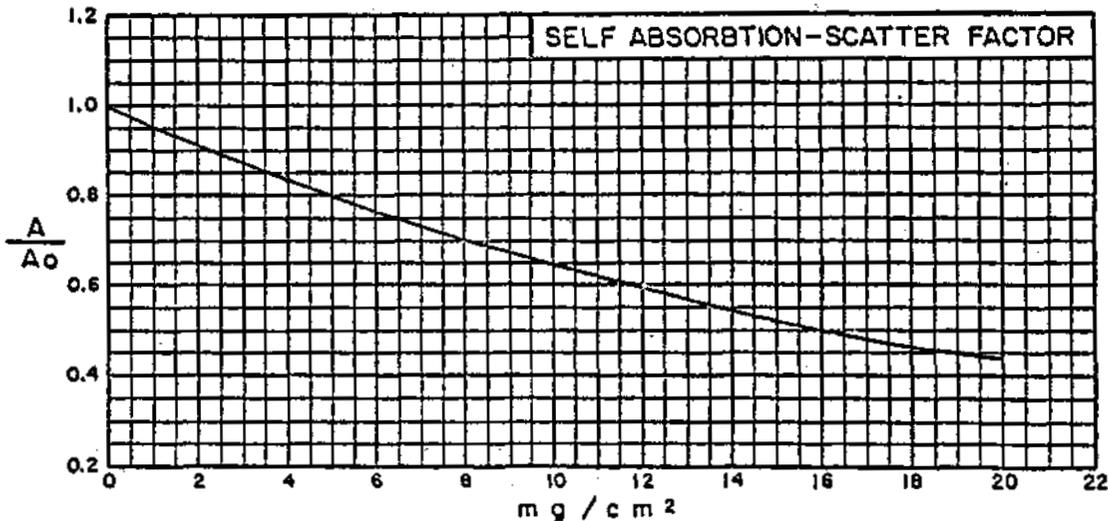
SHELF	AIR & MICA WINDOW FACTORS
1	0.50
2	0.48
3	0.40

SOURCE SPREAD DIAMETER FACTORS

MOUNTING EFFECTIVE AREA	1" S.S. DISH 4.5 cm <sup>2</sup>	1 1/2" S.S. DISH 10 cm <sup>2</sup>	1" GLASS (FLAT) 5.0 cm <sup>2</sup>	1.38" MILLIPORE 9.6 cm <sup>2</sup>	1 1/2" FILTER 13 cm <sup>2</sup>
SHELF 1	0.89	0.52	0.79	0.62	0.51
SHELF 2	0.97	0.74	0.85	0.73	0.66
SHELF 3	1.02	0.87	0.91	0.83	0.82

BACK-SCATTER FACTORS

SHELF	1	2	3	4	5
SHELF 1	1.31	1.31	1.16	1.12	1.08
SHELF 2	1.29	1.29	1.13	1.08	1.05
SHELF 3	1.27	1.27	1.11	1.07	1.05

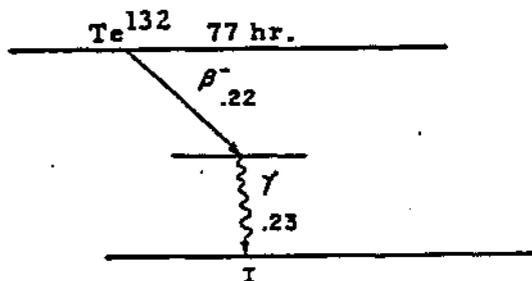


CALCULATION PROCEDURE:  $\frac{C/m \text{ (VOLUME FACTOR)}}{(\text{Geo.}) (2.2 \times 10^6) (\text{S.S.}) (\text{bs.}) (\text{S.S.A.}) (A + \text{M.W.}) (\text{Yield})} = \mu C / \text{unit}$

ISOTOPE Tellurium<sup>132</sup>

METHOD SO<sub>2</sub> - Reduction

YIELD 20.0 mg = 100%  
(As Te<sup>0</sup>)



$\mu_{Al} = 0.16$   $\mu_{Air} =$

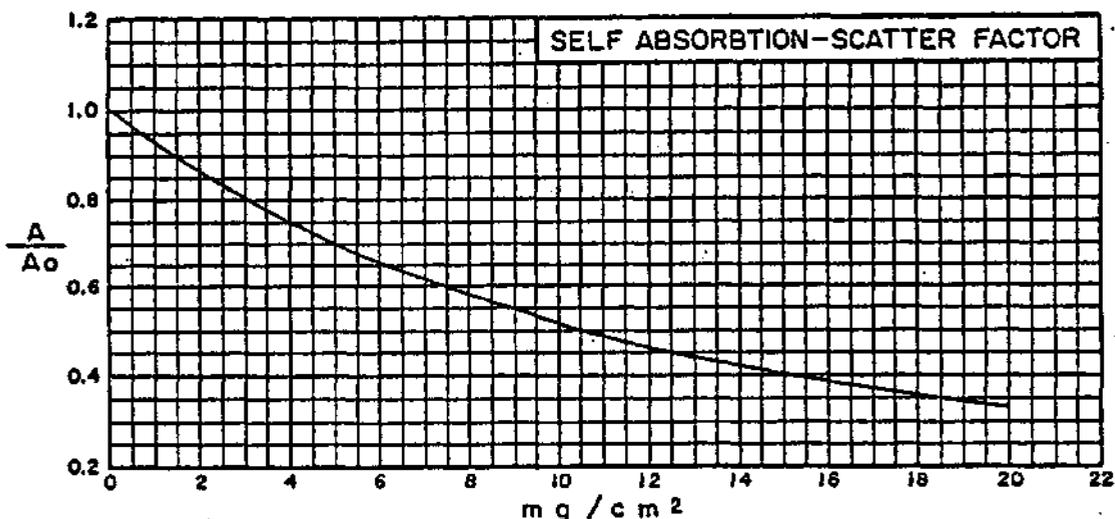
SHELF	AIR & MICA WINDOW FACTORS
1	0.56
2	0.42
3	0.31

SOURCE SPREAD DIAMETER FACTORS

MOUNTING EFFECTIVE AREA	1" S.S. DISH 4.5 cm <sup>2</sup>	1 1/2" S.S. DISH 10 cm <sup>2</sup>	1" GLASS (FLAT) 5.0 cm <sup>2</sup>	1.38" MILLIPORE 9.6 cm <sup>2</sup>	1 1/2" FILTER 13 cm <sup>2</sup>
SHELF 1	0.88	0.51	0.78	0.61	0.50
SHELF 2	0.96	0.72	0.84	0.72	0.65
SHELF 3	1.01	0.86	0.90	0.82	0.77

BACK-SCATTER FACTORS

SHELF 1	1.28	1.28	1.15	1.10	1.06
SHELF 2	1.27	1.27	1.12	1.07	1.04
SHELF 3	1.24	1.24	1.11	1.06	1.04



CALCULATION PROCEDURE:  $\frac{C/m \text{ (VOLUME FACTOR)}}{(\text{Geo.})(2.2 \times 10^6)(\text{S.S.})(\text{bs.})(\text{S.S.A.})(A+M.W.)(\text{Yield})} = \mu\text{C/unit}$

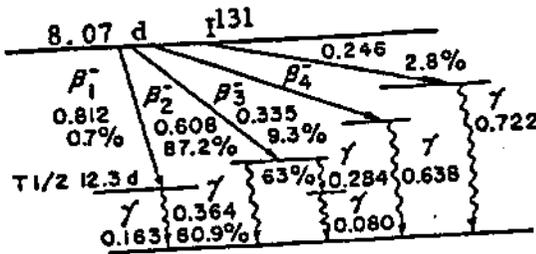
ISOTOPE Iodine<sup>131</sup>

$131_{53}I = 20 PdI_2 (20mg) = 0.039 mg$

METHOD Silver Iodide

YIELD 42.3 mg = 100%  
(As AgI standardized)

$\mu_{AI} = 0.039$   $\mu_{Air} =$



SHELF	AIR & MICA WINDOW FACTORS
1	0.87
2	0.82
3	0.76

SOURCE SPREAD DIAMETER FACTORS

MOUNTING EFFECTIVE AREA	1" S.S. DISH 4.5 cm <sup>2</sup>	1 1/2" S.S. DISH 10 cm <sup>2</sup>	1" GLASS (FLAT) 5.0 cm <sup>2</sup>	1.38" MILLIPORE 9.6 cm <sup>2</sup>	1 1/2" FILTER 13 cm <sup>2</sup>
SHELF 1	0.94	0.55	0.81	0.66	0.56
SHELF 2	1.02	0.78	0.88	0.79	0.73
SHELF 3	1.08	0.92	0.93	0.87	0.83

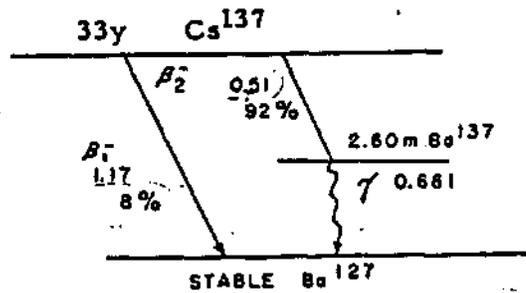
BACK-SCATTER FACTORS

SHELF 1	1.44	1.44	1.21	1.11	1.11
SHELF 2	1.42	1.42	1.17	1.07	1.07
SHELF 3				1.07	1.07

ISOTOPE Cesium<sup>137</sup>

METHOD\* Cesium Silicowolframate

YIELD 100 mg = 100%  
(As  $Cs_8SiW_{12}O_{42}$  standard)



$\mu_{Al} = 0.039$   $\mu_{Air} =$

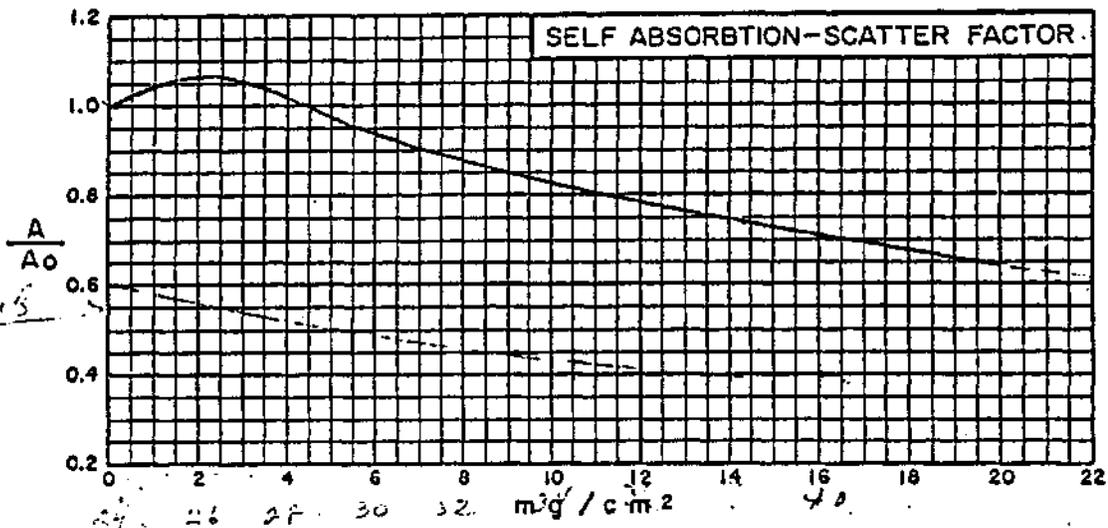
SHELF	AIR B MICA WINDOW FACTORS
1	0.87
2	0.81
3	0.75

SOURCE SPREAD DIAMETER FACTORS

MOUNTING EFFECTIVE AREA	1" S.S. DISH 4.5 cm <sup>2</sup>	1 1/2" S.S. DISH 10 cm <sup>2</sup>	1" GLASS (FLAT) 5.0 cm <sup>2</sup>	1.38" MILLIPORE 9.6 cm <sup>2</sup>	1 1/2" FILTER 13 cm <sup>2</sup>
SHELF 1	0.93	0.52	0.81	0.66	0.56
SHELF 2	1.01	0.74	0.88	0.79	0.73
SHELF 3	1.07	0.87	0.93	0.87	0.83

BACK-SCATTER FACTORS

SHELF 1	1.44	1.44	1.21	1.19	1.11
SHELF 2	1.42	1.42	1.17	1.13	1.07
SHELF 3	1.38	1.38	1.15	1.12	1.07



CALCULATION PROCEDURE:  $\frac{c/m \text{ (VOLUME FACTOR)}}{(Geo)(2.2 \times 10^6)(S.S.)(bs.)(S.S.A.)(A+M.W.)(Yield)}$   $\mu C/unit$

Remarks:  $Cs^{137}$  as Cesium Silicowolframate on one inch dishes (shelf 1)

\* Additional Method Chloroplatinic Acid      Mounting 1" S S dish      Yield 50.7 mg = 100%

~~1.569 x 10^5~~  $\frac{c/unit}{(1.569 \times 10^5)(S.S.A.)(Y)(V)}$

-39-

ISOTOPE Barium<sup>140</sup>

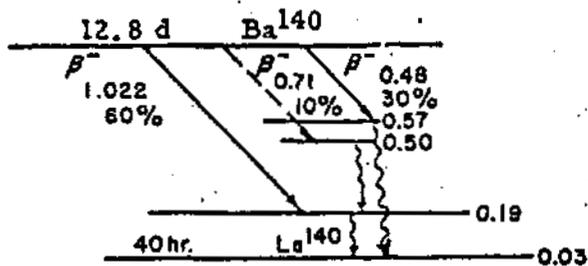
HW-18258-APP

METHOD Barium Chromate

YIELD 36.8 mg = 100%

(As BaCrO<sub>4</sub>)

$\mu_{Al} = 0.023$   $\mu_{Air} =$



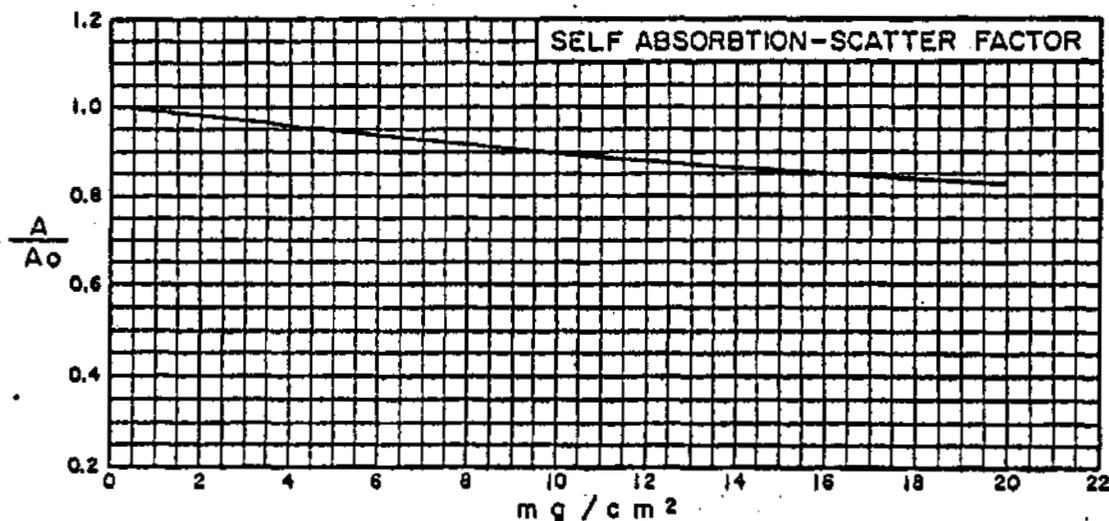
SHELF	AIR & MICA WINDOW FACTORS
1	0.92
2	0.88
3	0.84

SOURCE SPREAD DIAMETER FACTORS

MOUNTING EFFECTIVE AREA	1" S.S. DISH 4.5 cm <sup>2</sup>	1 1/2" S.S. DISH 10 cm <sup>2</sup>	1" GLASS (FLAT) 5.0 cm <sup>2</sup>	138" MILLIPORE 9.6 cm <sup>2</sup>	1 1/2" FILTER 13 cm <sup>2</sup>
SHELF 1	0.96	0.56	0.81	0.66	0.56
SHELF 2	1.05	0.80	0.88	0.79	0.73
SHELF 3	1.10	0.94	0.93	0.87	0.83

BACK-SCATTER FACTORS

SHELF 1	1.44	1.44	1.24	1.19	1.10
SHELF 2	1.42	1.42	1.19	1.13	1.07
SHELF 3	1.38	1.38	1.17	1.12	1.06



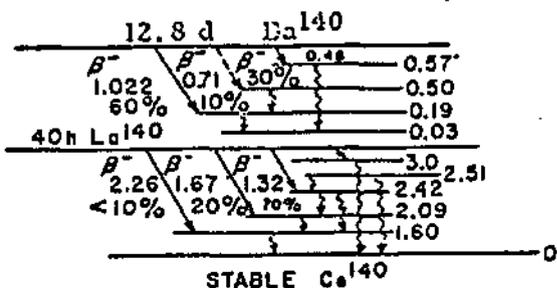
CALCULATION PROCEDURE:  $\frac{C/m \text{ (VOLUME FACTOR)}}{(\text{Geo.})(2.2 \times 10^8)(\text{S.S.})(\text{b.s.})(\text{S.S.A.})(A+M.W.)(\text{Yield})} = \mu\text{C/unit}$

METHOD Barium Chromate

YIELD 36.0 mg = 100%

(As Ba CrO<sub>4</sub>)

$\mu_{Ai} = 0.014$   $\mu_{Air} =$



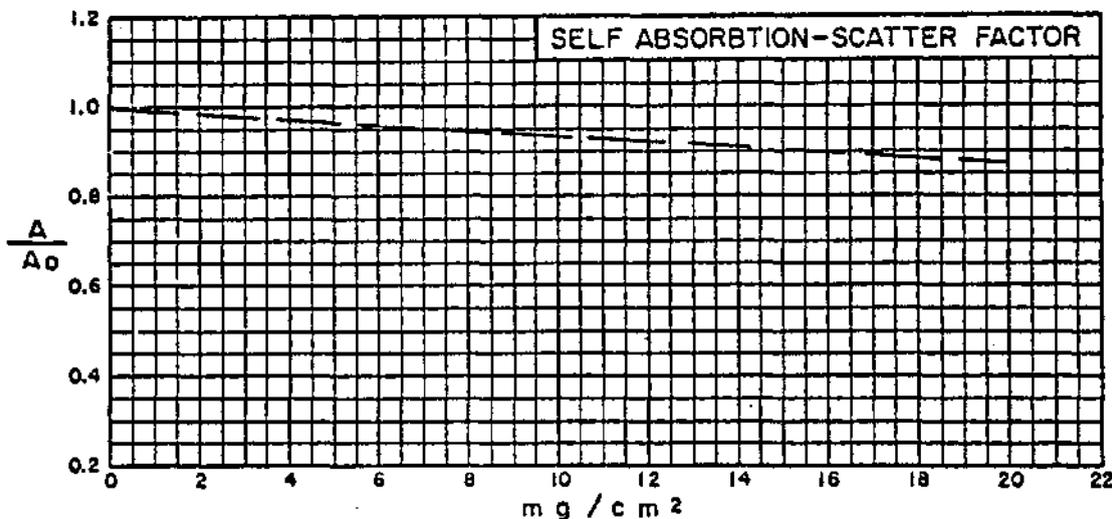
SHELF	AIR & MICA WINDOW FACTORS
1	0.95
2	0.92
3	0.89

SOURCE SPREAD DIAMETER FACTORS

MOUNTING EFFECTIVE AREA	1" S.S. DISH 4.5 cm <sup>2</sup>	1 1/2" S.S. DISH 10 cm <sup>2</sup>	1" GLASS (FLAT) 5.0 cm <sup>2</sup>	1.38" MILLIPORE 9.6 cm <sup>2</sup>	1 1/2" FILTER 13 cm <sup>2</sup>
SHELF 1	0.98	0.58	0.81	0.66	0.56
SHELF 2	1.07	0.82	0.88	0.79	0.73
SHELF 3	1.13	0.97	0.93	0.87	0.83

BACK-SCATTER FACTORS

SHELF 1	1.44	1.44	1.24	1.18	1.09
SHELF 2	1.42	1.42	1.19	1.12	1.06
SHELF 3	1.38	1.38	1.17	1.11	1.05



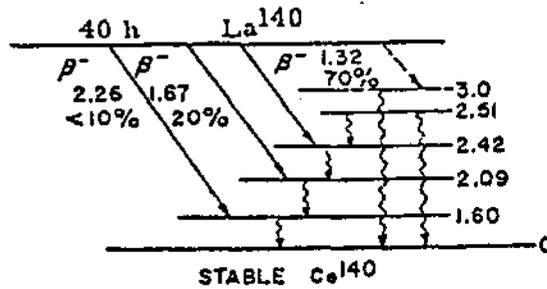
CALCULATION PROCEDURE:  $\frac{C/m \text{ (VOLUME FACTOR)}}{(\text{Geo.})(2.2 \times 10^6)(\text{S.S.})(\text{bs.})(\text{S.S.A.})(\text{A+MW.})(\text{Yield})} = \mu\text{C/unit}$

Remarks:  $\frac{A}{A_0} = \frac{1}{\mu x} (1 - e^{-\mu x})$

METHOD Lanthanum Fluoride

YIELD 24.6 mg = 100%  
(As  $\text{La}_2\text{O}_3$ )

$\mu_{\text{Al}} = 0.008$   $\mu_{\text{Alr}} =$  \_\_\_\_\_



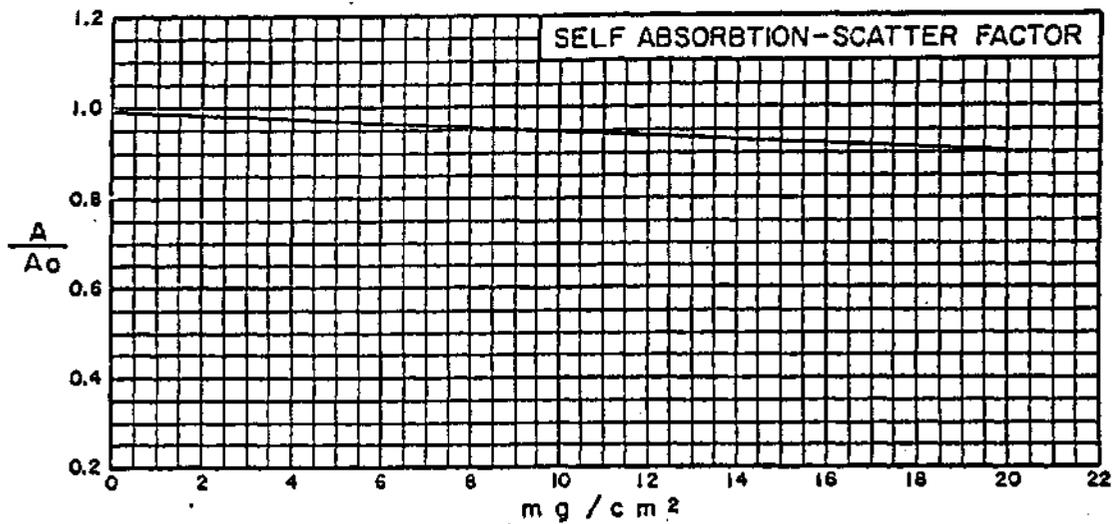
SHELF	AIR & MICA WINDOW FACTORS
1	0.97
2	0.96
3	0.95

SOURCE SPREAD DIAMETER FACTORS

MOUNTING EFFECTIVE AREA	1" S.S. DISH 4.5 cm <sup>2</sup>	1 1/2" S.S. DISH 10 cm <sup>2</sup>	1" GLASS (FLAT) 5.0 cm <sup>2</sup>	1.38" MILLIPORE 9.6 cm <sup>2</sup>	1 1/2" FILTER 13 cm <sup>2</sup>
SHELF 1	1.00	0.59	0.81	0.66	0.56
SHELF 2	1.09	0.84	0.88	0.79	0.73
SHELF 3	1.15	0.99	0.93	0.87	0.83

BACK-SCATTER FACTORS

SHELF 1	1.44	1.44	1.25	1.17	1.08
SHELF 2	1.42	1.42	1.20	1.11	1.05
SHELF 3	1.38	1.38	1.18	1.10	1.05



CALCULATION PROCEDURE:  $\frac{c/m \text{ (VOLUME FACTOR)}}{(\text{Geo.})(2.2 \times 10^6)(\text{S.S.})(\text{bs.})(\text{S.S.A.})(A + \text{M.W.})(\text{Yield})} = \mu\text{C/unit}$

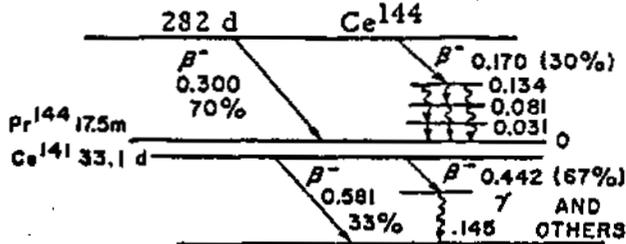
ISOTOPE Rare Earths\*

METHOD Ceric Fluoride

YIELD 23.4 mg = 100%

(As Ce<sub>2</sub>O<sub>3</sub>)

$\mu_{Al} = 0.055$   $\mu_{Air} =$



SHELF	AIR & MICA WINDOW FACTORS
1	0.82
2	0.76
3	0.69

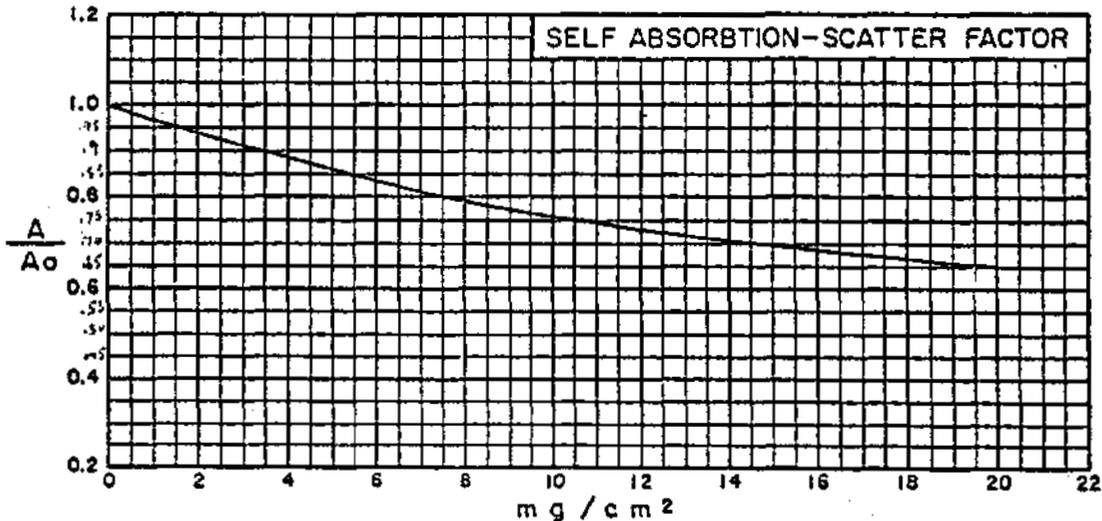
STABLE Pr<sup>141</sup>

SOURCE SPREAD DIAMETER FACTORS

MOUNTING EFFECTIVE AREA	1" S.S. DISH 4.5 cm <sup>2</sup>	1 1/2" S.S. DISH 10 cm <sup>2</sup>	1" GLASS (FLAT) 5.0 cm <sup>2</sup>	1.38" MILLIPORE 9.6 cm <sup>2</sup>	1 1/2" FILTER 13 cm <sup>2</sup>
SHELF 1	0.95	0.56	0.81	0.64	0.54
SHELF 2	1.03	0.79	0.87	0.77	0.70
SHELF 3	1.09	0.94	0.92	0.85	0.81

BACK-SCATTER FACTORS

SHELF 1	1.36	1.36	1.21	1.14	1.08
SHELF 2	1.34	1.34	1.17	1.10	1.05
SHELF 3	1.31	1.31	1.15	1.09	1.05



CALCULATION PROCEDURE:  $\frac{C/m \text{ (VOLUME FACTOR)}}{(\text{Geo})(2.2 \times 10^8)(\text{S.S.})(\text{bs.})(\text{S.S.A})(A+M.W.)(\text{Yield})} = \mu C/\text{unit}$

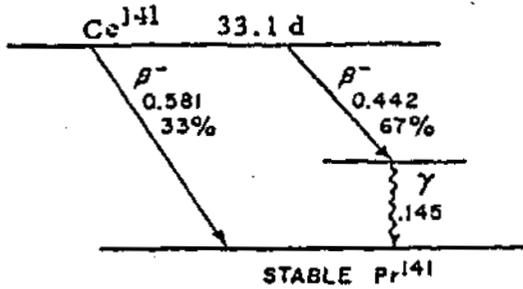
\*Remarks: Assume 1/3 Ce<sup>141</sup>, 1/3 Ce<sup>144</sup>, 1/3 Pr<sup>144</sup>

ISOTOPE Cerium<sup>141</sup>

METHOD Cerium Fluoride

YIELD 23.4 mg = 100%  
(As Ce<sub>2</sub>O<sub>3</sub>)

$\mu_{Air} = 0.045$   $\mu_{Air} =$



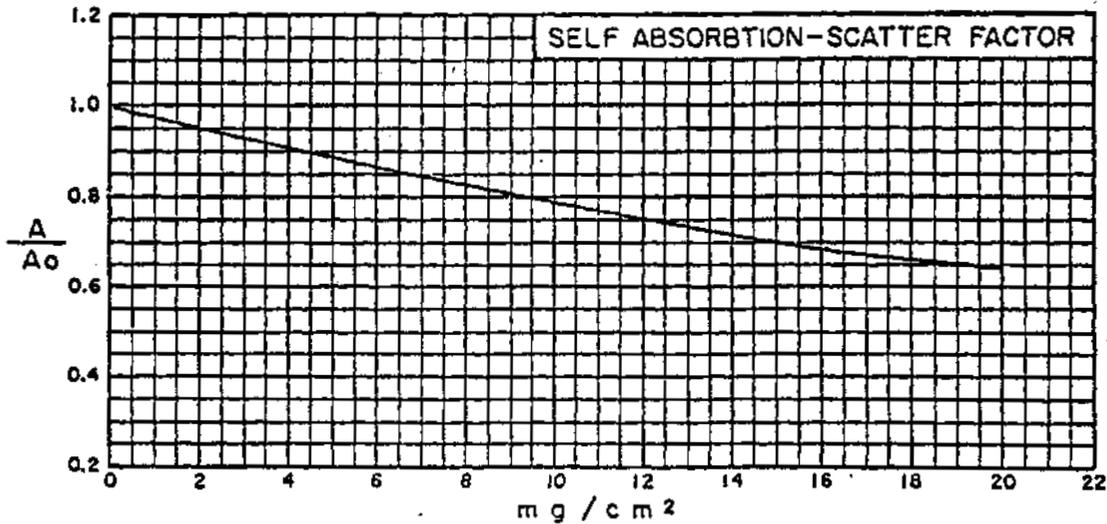
SHELF	AIR & MICA WINDOW FACTORS
1	0.85
2	0.79
3	0.71

SOURCE SPREAD DIAMETER FACTORS

MOUNTING EFFECTIVE AREA	1" S.S. DISH 4.5 cm <sup>2</sup>	1 1/2" S.S. DISH 10 cm <sup>2</sup>	1" GLASS (FLAT) 5.0 cm <sup>2</sup>	1.38" MILLIPORE 9.6 cm <sup>2</sup>	1 1/2" FILTER 13 cm <sup>2</sup>
SHELF 1	0.93	0.54	0.81	0.66	0.56
SHELF 2	1.01	0.77	0.88	0.79	0.73
SHELF 3	1.07	0.91	0.93	0.87	0.83

BACK-SCATTER FACTORS

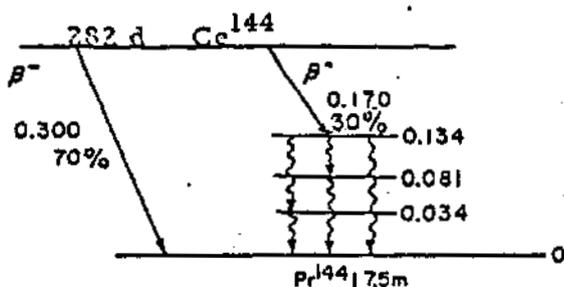
SHELF 1	1.43	1.43	1.22	1.19	1.11
SHELF 2	1.41	1.41	1.17	1.13	1.07
SHELF 3	1.37	1.37	1.16	1.12	1.07



CALCULATION PROCEDURE:  $\frac{C/m \text{ (VOLUME FACTOR)}}{(\text{Geo.}) (2.2 \times 10^6) (\text{S.S.}) (\text{bs.}) (\text{S.S.A.}) (A + \text{M.W.}) (\text{Yield})} = \mu\text{C/unit}$

METHOD Cerium Fluoride

YIELD 23.4 mg = 100%  
(As Ce<sub>2</sub>O<sub>3</sub>)



$\mu_{Al} = 0.13$      $\mu_{Air} =$

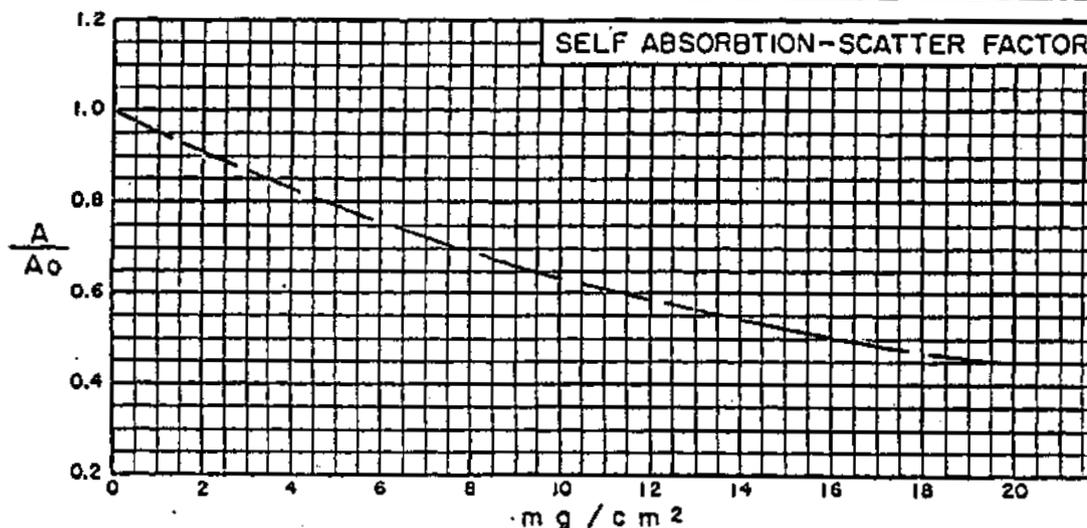
SHELF	AIR & MICA WINDOW FACTOR
1	0.62
2	0.49
3	0.39

SOURCE SPREAD DIAMETER FACTORS

MOUNTING EFFECTIVE AREA	1" S.S. DISH 4.5 cm <sup>2</sup>	1 1/2" S.S. DISH 10 cm <sup>2</sup>	1" GLASS (FLAT) 5.0 cm <sup>2</sup>	1.38" MILLIPORE 9.6 cm <sup>2</sup>	1 1/2" FILTER 15 cm <sup>2</sup>
SHELF 1	0.89	0.51	0.78	0.61	0.50
SHELF 2	0.97	0.72	0.84	0.72	0.65
SHELF 3	1.02	0.86	0.90	0.82	0.77

BACK-SCATTER FACTORS

SHELF 1	1.30	1.30	1.16	1.12	1.09
SHELF 2	1.29	1.29	1.13	1.08	1.06
SHELF 3	1.26	1.26	1.11	1.07	1.05



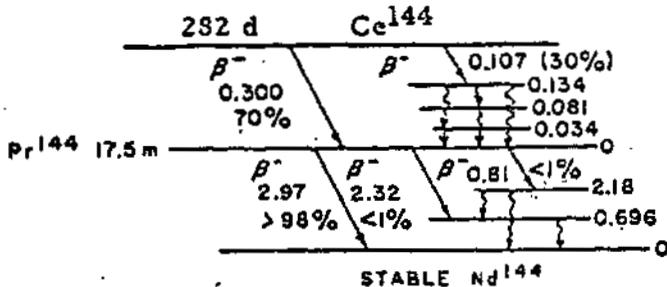
CALCULATION PROCEDURE:  $\frac{C/m \text{ (VOLUME FACTOR)}}{(\text{Geo.})(2.2 \times 10^6)(\text{S.S.})(\text{bs.})(\text{S.S.A.})(A+M.W.)(\text{Yield})} = \mu C / \mu n$

Remarks:  $\frac{A}{A_0} = \frac{1}{\mu x} (1 - e^{-\mu x})$

ISOTOPE Cerium<sup>144</sup> - Praseodymium<sup>144</sup>

METHOD Ceric Flouride

YIELD 23.4 mg = 100%  
(As Ce O<sub>3</sub>)



$\mu_{Al} = 0.06$   $\mu_{Air} =$  \_\_\_\_\_

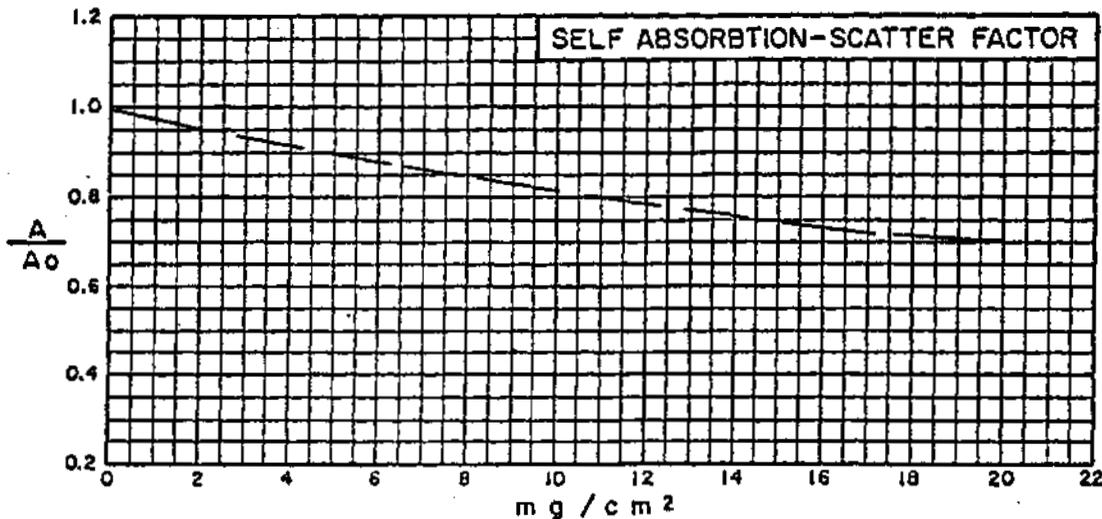
SHELF	AIR & MICA WINDOW FACTORS
1	0.80
2	0.74
3	0.69

SOURCE SPREAD DIAMETER FACTORS

MOUNTING EFFECTIVE AREA	1" S.S. DISH 4.5 cm <sup>2</sup>	1 1/2" S.S. DISH 10 cm <sup>2</sup>	1" GLASS (FLAT) 5.0 cm <sup>2</sup>	1/38" MILLIPORE 9.6 cm <sup>2</sup>	1 1/2" FILTER 13 cm <sup>2</sup>
SHELF 1	0.96	0.56	0.80	0.64	0.53
SHELF 2	1.04	0.80	0.86	0.76	0.69
SHELF 3	1.10	0.95	0.92	0.85	0.80

BACK-SCATTER FACTORS

SHELF 1	1.33	1.33	1.21	1.12	1.07
SHELF 2	1.31	1.31	1.17	1.08	1.05
SHELF 3	1.28	1.28	1.15	1.07	1.04



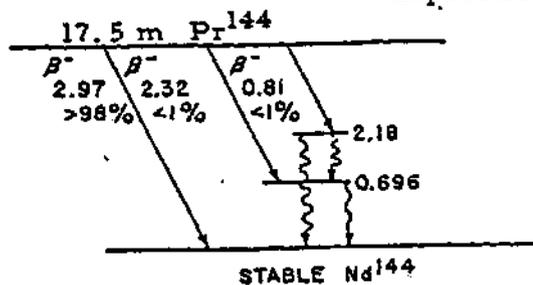
CALCULATION PROCEDURE:  $\frac{C/m \text{ (VOLUME FACTOR)}}{(\text{Geo.})(2.2 \times 10^6)(\text{S.S.})(\text{b.s.})(\text{S.S.A.})(A+M.W.)(\text{Yield})} = \mu\text{C/unit}$

Remarks:  $\frac{A}{A_0} = \frac{1}{\mu x} (1 - e^{-\mu x})$

ISOTOPE Praseodymium<sup>144</sup>

METHOD Praseodymium - Cerium Separation

YIELD 50.8 mg = 100%  
(As Nd<sub>2</sub>(C<sub>2</sub>O<sub>4</sub>)<sub>3</sub> · 10 H<sub>2</sub>O)  
μ<sub>Ai</sub> = 0.0025 μ<sub>Air</sub> = \_\_\_\_\_



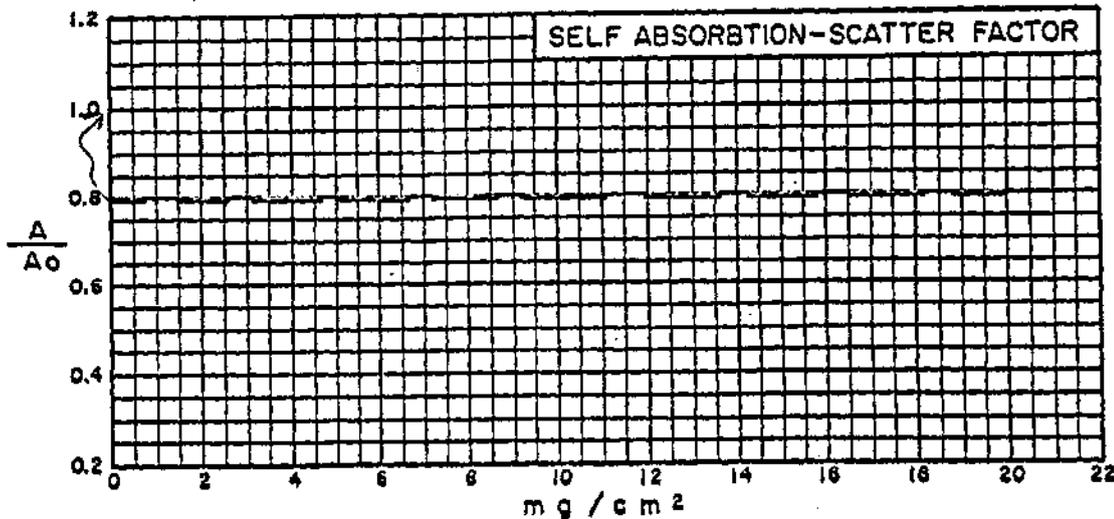
SHELF	AIR B MICA WINDOW FACTORS
1	0.99
2	0.99
3	0.98

SOURCE SPREAD DIAMETER FACTORS

MOUNTING EFFECTIVE AREA	1" S.S. DISH 4.5 cm <sup>2</sup>	1 1/2" S.S. DISH 10 cm <sup>2</sup>	1" GLASS (FLAT) 5.0 cm <sup>2</sup>	1.38" MILLIPORE 9.6 cm <sup>2</sup>	1 1/2" FILTER 13 cm <sup>2</sup>
SHELF 1	1.03	0.62	0.81	0.66	0.56
SHELF 2	1.12	0.88	0.88	0.79	0.73
SHELF 3	1.18	1.04	0.93	0.87	0.83

BACK-SCATTER FACTORS

SHELF 1	1.35	1.35	1.26	1.12	1.05
SHELF 2	1.33	1.33	1.21	1.08	1.03
SHELF 3	1.30	1.30	1.18	1.07	1.03



CALCULATION PROCEDURE:  $\frac{C/m \text{ (VOLUME FACTOR)}}{(\text{Geo.})(2.2 \times 10^6)(\text{S.S.})(\text{b.a.})(\text{S.S.A.})(A+M.W.)(\text{Yield})} = \mu C/\text{unit}$

Remarks:  $\frac{A}{A_0} = \frac{1}{\mu x} (1 - e^{-\mu x})$

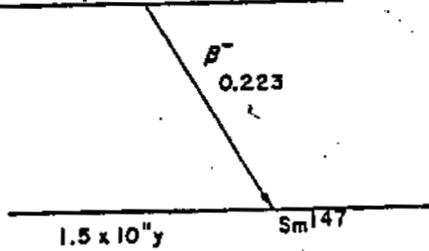
ISOTOPE Promethium<sup>147</sup>

METHOD Promethium Fluoride

YIELD 50.8 mg = 100%  
(As Nd<sub>2</sub>(C<sub>2</sub>O<sub>4</sub>)<sub>3</sub>·10 H<sub>2</sub>O)

2.6 y Pm<sup>147</sup>

$\mu_{Ai} = 0.158$ ;  $\mu_{Air} =$



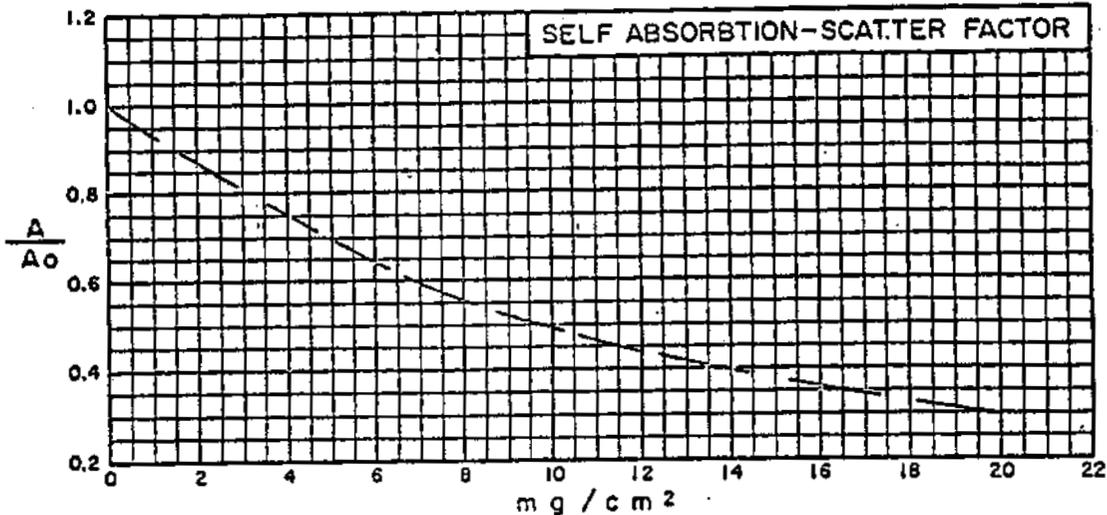
SHELF	AIR B MICA WINDOW FACTORS
1	0.57
2	0.42
3	0.31

SOURCE SPREAD DIAMETER FACTORS

MOUNTING EFFECTIVE AREA	1" S.S. DISH 4.5 cm <sup>2</sup>	1 1/2" S.S. DISH 10 cm <sup>2</sup>	1" GLASS (FLAT) 5.0 cm <sup>2</sup>	1.38" MILLIPORE 9.6 cm <sup>2</sup>	1 1/2" FILTER 13 cm <sup>2</sup>
SHELF 1	0.88	0.51	0.78	0.61	0.50
SHELF 2	0.96	0.72	0.84	0.72	0.65
SHELF 3	1.01	0.86	0.90	0.82	0.77

BACK-SCATTER FACTORS

SHELF 1	1.28	1.28	1.15	1.10	1.08
SHELF 2	1.27	1.27	1.12	1.07	1.06
SHELF 3	1.24	1.24	1.11	1.06	1.05



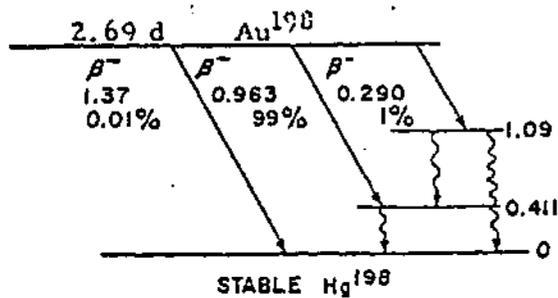
CALCULATION PROCEDURE:  $\frac{C/m \text{ (VOLUME FACTOR)}}{(\text{Geo.})(2.2 \times 10^6)(\text{S.S.})(\text{bs.})(\text{S.S.A.})(A+\text{M.W.})(\text{Yield})} = \mu\text{C/unit}$

Remarks:  $\frac{A}{A_0} = \frac{1}{\mu x} (1 - e^{-\mu x})$

METHOD Ethyl Acetate Extraction

YIELD 5 mg = 100%  
(As Au<sup>v</sup>)

$\mu_{Air} = 0.015$   $\mu_{Air} =$  \_\_\_\_\_



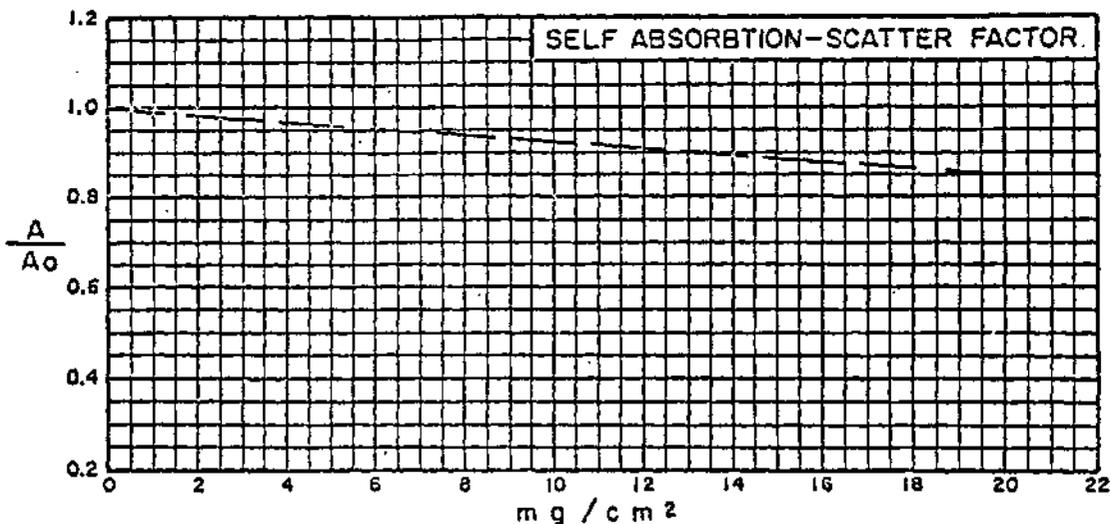
SHELF	AIR & MICA WINDOW FACTORS
1	0.95
2	0.92
3	0.89

SOURCE SPREAD DIAMETER FACTORS

MOUNTING EFFECTIVE AREA	1" S.S. DISH 4.3 cm <sup>2</sup>	1 1/2" S.S. DISH 10 cm <sup>2</sup>	1" GLASS (FLAT) 5.0 cm <sup>2</sup>	1.38" MILLIPORE 9.6 cm <sup>2</sup>	1 1/2" FILTER 13 cm <sup>2</sup>
SHELF 1	0.97	0.57	0.81	0.66	0.56
SHELF 2	1.06	0.81	0.88	0.79	0.73
SHELF 3	1.12	0.96	0.93	0.87	0.83

BACK-SCATTER FACTORS

SHELF 1	1.45	1.45	1.24	1.19	1.10
SHELF 2	1.43	1.43	1.19	1.13	1.07
SHELF 3	1.39	1.39	1.17	1.12	1.06



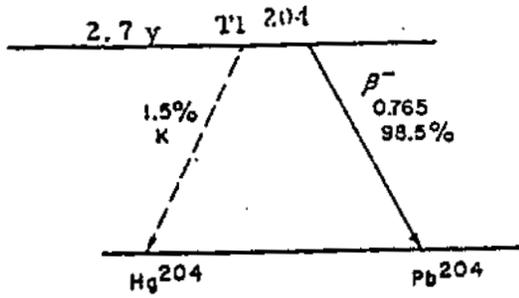
CALCULATION PROCEDURE:  $\frac{C/m \text{ (VOLUME FACTOR)}}{(\text{Geo.})(2.2 \times 10^6)(\text{S.S.})(\text{b.s.})(\text{S.S.A.})(A + \text{M.W.})(\text{Yield})} = \mu\text{C/unit}$

Remarks:  $\frac{A}{A_0} = \frac{1}{\mu x} (1 - e^{-\mu x})$

ISOTOPE Thallium 204

METHOD Spike - Direct Plate

YIELD \_\_\_\_\_

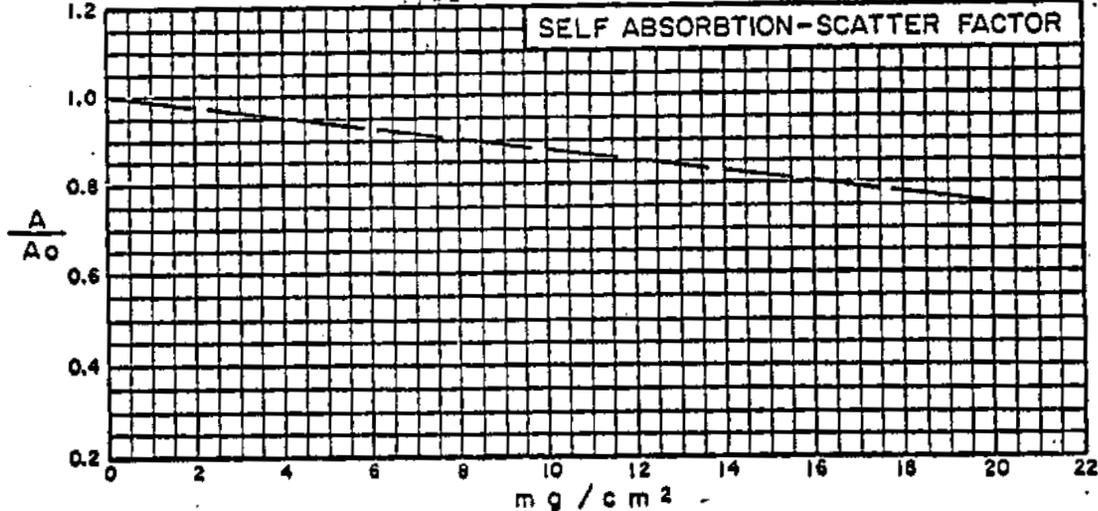


$\mu_{Al} = 0.0212$   $\mu_{Air} = 360$

SHELF	AIR & MICA WINDOW FACTORS
1	0.93 (0.98)
2	0.89 (0.93)
3	0.85 (0.88)
4	0.81 (0.84)
5	0.76

SOURCE SPREAD DIAMETER FACTORS

MOUNTING EFFECTIVE AREA	1" S.S. DISH 4.5 cm <sup>2</sup>	1 1/2" S.S. DISH 10 cm <sup>2</sup>	1" GLASS (FLAT) 5.0 cm <sup>2</sup>	1.38" MILLIPORE 9.6 cm <sup>2</sup>	1 1/2" FILTER 13 cm <sup>2</sup>	
SHELF 1	0.95	0.56	0.81	0.66	0.56	
SHELF 2	1.04	0.80	0.88	0.79	0.73	
SHELF 3	1.09	0.94	0.93	0.87	0.83	
<i>Shelf 4</i>	BACK-SCATTER FACTORS				0.95	.93
SHELF 1	1.45	1.45	1.23	1.20	1.10	
SHELF 2	1.43	1.43	1.18	1.13	1.07	
SHELF 3	1.39	1.39	1.16	1.12	1.06	



CALCULATION PROCEDURE:  $\frac{C/m \text{ (VOLUME FACTOR)}}{(Geo.) \times (2.2 \times 10^6) \times (S.S.) \times (bs.) \times (S.S.A.) \times (A+M.W.) \times (Yield)} = \mu C/Unit$

Remarks:  $\frac{A}{A_0} = \frac{1}{\mu x} (1 - e^{-\mu x})$

shelf 3 .0675  
 5 .0149

ISOTOPE Bismuth<sup>210</sup> (RaE)

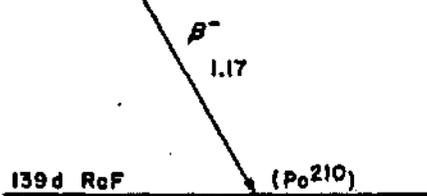
METHOD Bismuth Sulfide

YIELD 49.2 mg = 100%

(As Bi<sub>2</sub>O<sub>3</sub>)

$\mu_{Al} = 0.011$   $\mu_{Alr} =$

5 d RaE (Bi<sup>210</sup>)



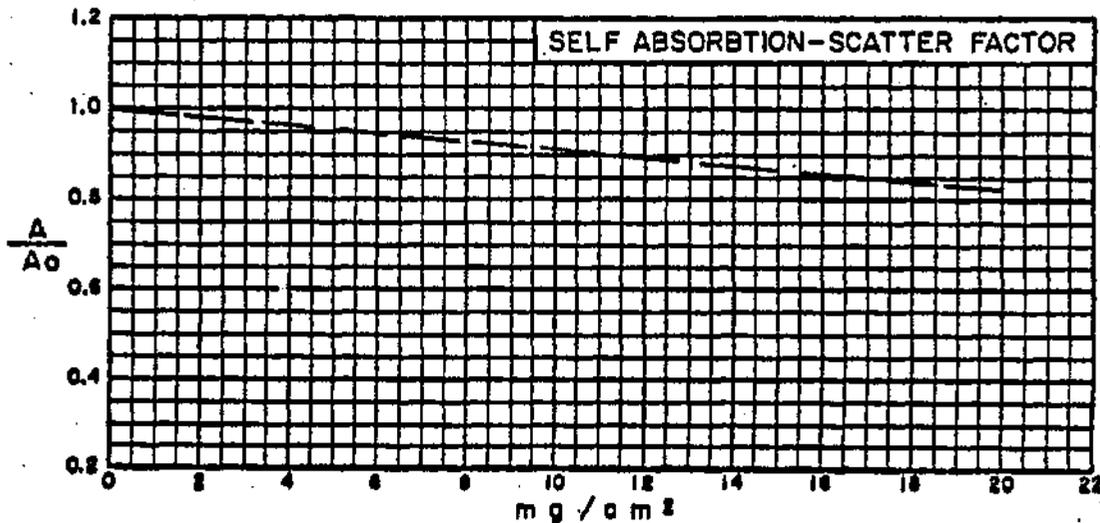
SHELF	AIR & MICA WINDOW FACTORS
1	0.96
2	0.94
3	0.92

SOURCE SPREAD DIAMETER FACTORS

MOUNTING EFFECTIVE AREA	1" S.S. DISH 4.5 cm <sup>2</sup>	1 1/2" S.S. DISH 10 cm <sup>2</sup>	1" GLASS (FLAT) 6.0 cm <sup>2</sup>	1.38" MILLIPORE 9.6 cm <sup>2</sup>	1 1/2" FILTER 13 cm <sup>2</sup>
SHELF 1	0.98	0.58	0.81	0.66	0.56
SHELF 2	1.08	0.82	0.88	0.79	0.73
SHELF 3	1.13	0.97	0.93	0.87	0.83

BACK-SCATTER FACTORS

SHELF 1	1.45	1.45	1.25	1.18	1.09
SHELF 2	1.43	1.43	1.20	1.12	1.06
SHELF 3	1.39	1.39	1.18	1.11	1.05



CALCULATION PROCEDURE:  $\frac{C/m \text{ (VOLUME FACTOR)}}{(Geo.) (2.2 \times 10^4) (S.S.) (b.s.) (S.S.A.) (A+M.W.) (Yield)} = \mu C / \text{unit}$

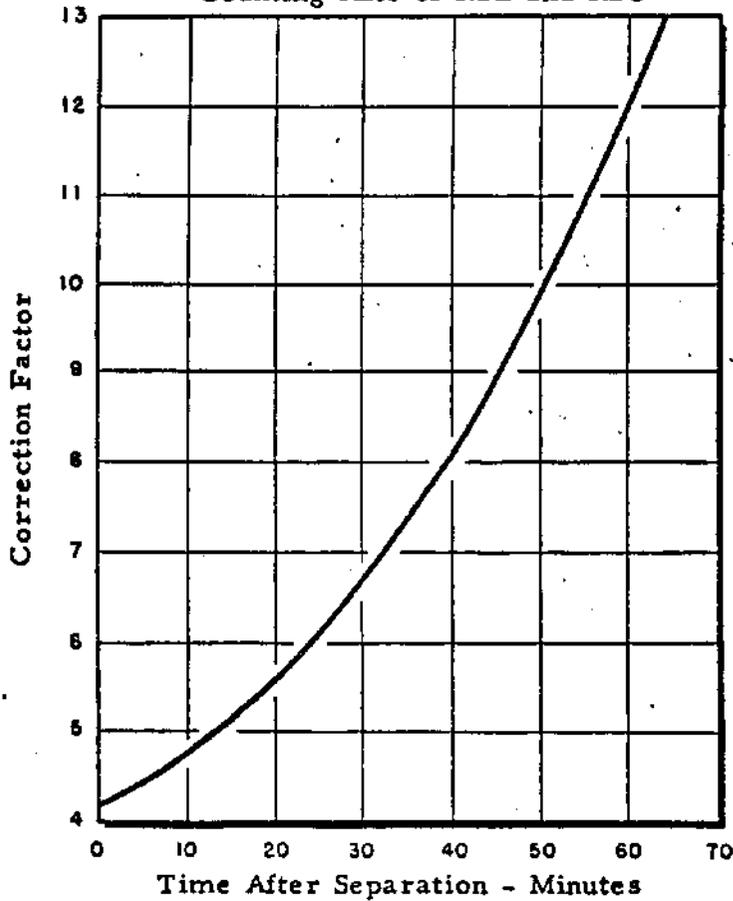
Remarks:  $\frac{A}{A_0} = \frac{1}{\mu x} (1 - e^{-\mu x})$

RADON<sup>222</sup>

METHOD: Lead Sulfide

Rn <sup>222</sup>		3.825d
Po <sup>218</sup> (RaA)	$\alpha$ 5.49	3.0 M
Pb <sup>214</sup> (RaB)	$\alpha$ 6.0	26.8 M
Bi <sup>214</sup> (RaC)	$\beta$ .65	19.7 M
Po <sup>214</sup> (RaC')	$\alpha$ 5.5(1%)	$\beta$ 1.65 (99%) 154 $\mu$ S
Tl <sup>210</sup> (RaC'')		1.32m
Pb <sup>210</sup> (RaD)	$\beta$ 1.9	22Y

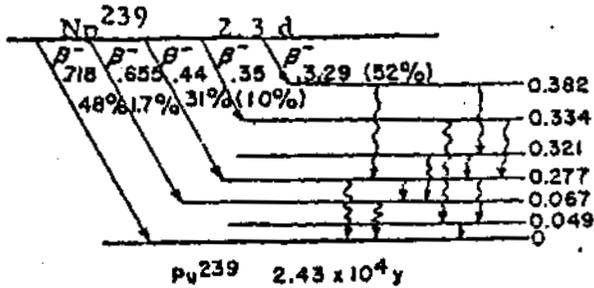
Radon Disintegration Rate From  
Counting Rate of RaB and RaC



ISOTOPE Neptunium<sup>239</sup>

METHOD TTA Extraction

YIELD Carrier Free



$\mu_{Al} = 0.088$   $\mu_{Air} =$  \_\_\_\_\_

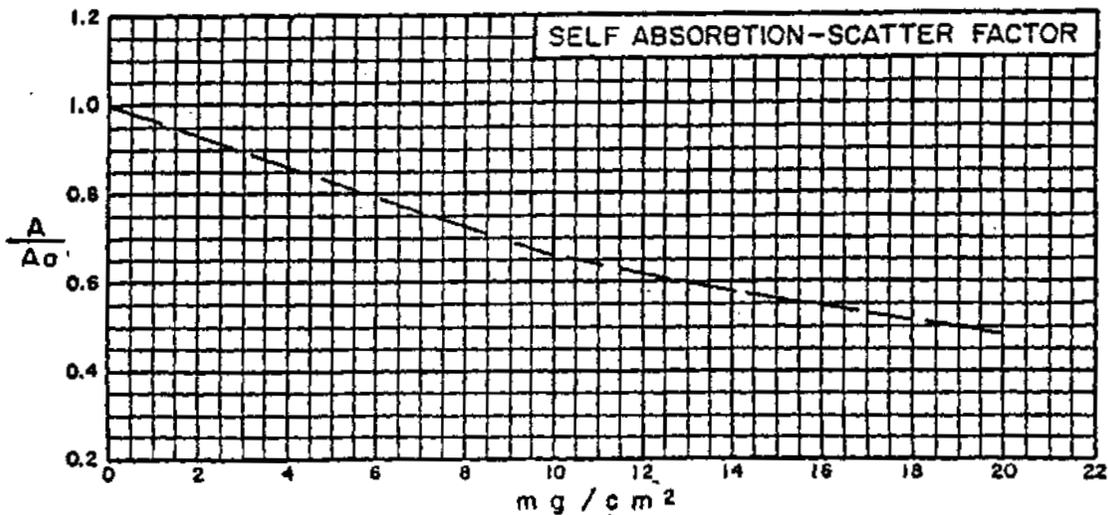
SHELF	AIR & MICA WINDOW FACTORS
1	0.73
2	0.62
3	0.52

SOURCE SPREAD DIAMETER FACTORS

MOUNTING EFFECTIVE AREA	1" S.S. DISH 4.5 cm <sup>2</sup>	1 1/2" S.S. DISH 10 cm <sup>2</sup>	1" GLASS (FLAT) 5.0 cm <sup>2</sup>	1.38" MILLIPORE 9.6 cm <sup>2</sup>	1 1/2" FILTER 13 cm <sup>2</sup>
SHELF 1	0.90	0.53	0.81	0.66	0.56
SHELF 2	0.98	0.75	0.88	0.79	0.73
SHELF 3	1.04	0.89	0.93	0.87	0.83

BACK-SCATTER FACTORS

SHELF 1	1.34	1.34	1.18	1.14	1.11
SHELF 2	1.32	1.32	1.14	1.09	1.07
SHELF 3	1.29	1.29	1.13	1.09	1.07



CALCULATION PROCEDURE:  $\frac{C/m \text{ (VOLUME FACTOR)}}{(\text{Geo})(2.2 \times 10^6)(\text{S.S.})(\text{bs.})(\text{S.S.A})(\text{A}+\text{M.W.})(\text{Yield})} = \mu\text{C/unit}$

Remarks:  $\frac{A}{A_0} = \frac{1}{\mu x} (1 - e^{-\mu x})$

-53-  
ISOTOPE URANIUM

HW-18258-APP

METHOD \_\_\_\_\_

YIELD \_\_\_\_\_

$\mu_{Al} =$  \_\_\_\_\_  $\mu_{Air} =$  \_\_\_\_\_

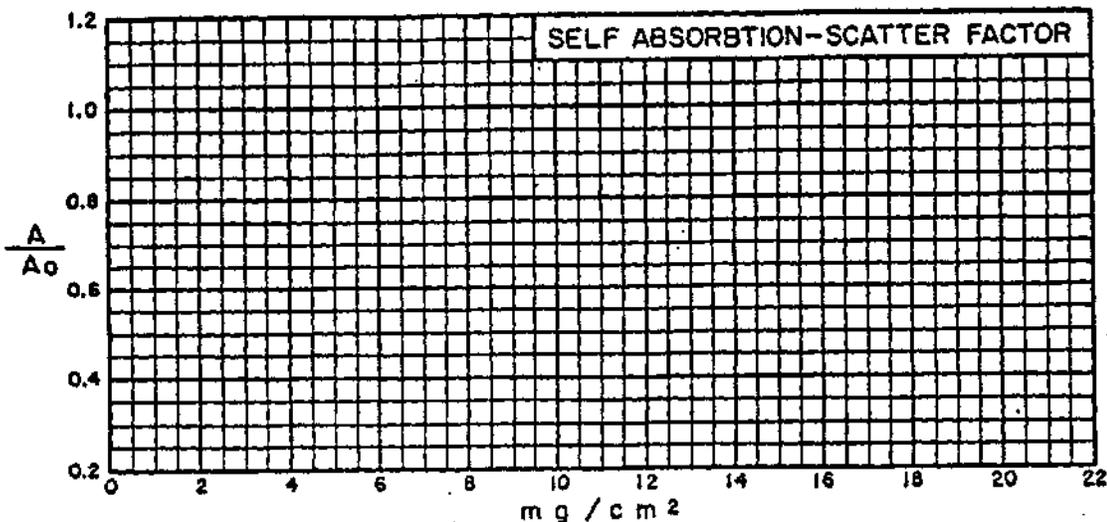
SHELF	AIR & MICA WINDOW FACTORS
1	_____
2	_____
3	_____

SOURCE SPREAD DIAMETER FACTORS

MOUNTING EFFECTIVE AREA	1" S.S. DISH 4.5 cm <sup>2</sup>	1 1/2" S.S. DISH 10 cm <sup>2</sup>	1" GLASS (FLAT) 5.0 cm <sup>2</sup>	1.38" MILLIPORE 9.6 cm <sup>2</sup>	1 1/2" FILTER 13 cm <sup>2</sup>
SHELF 1					
SHELF 2					
SHELF 3					

BACK-SCATTER FACTORS

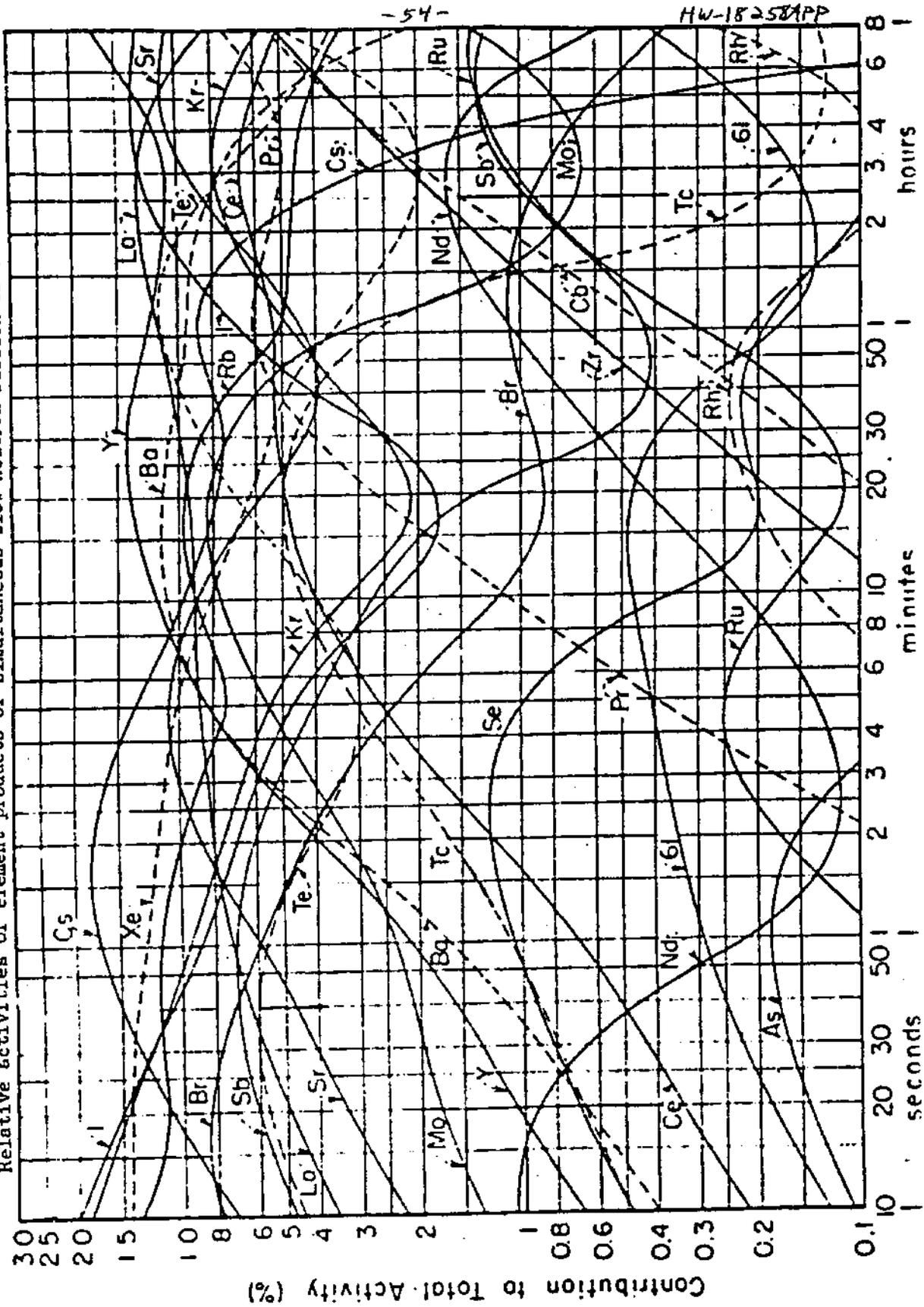
SHELF 1					
SHELF 2					
SHELF 3					



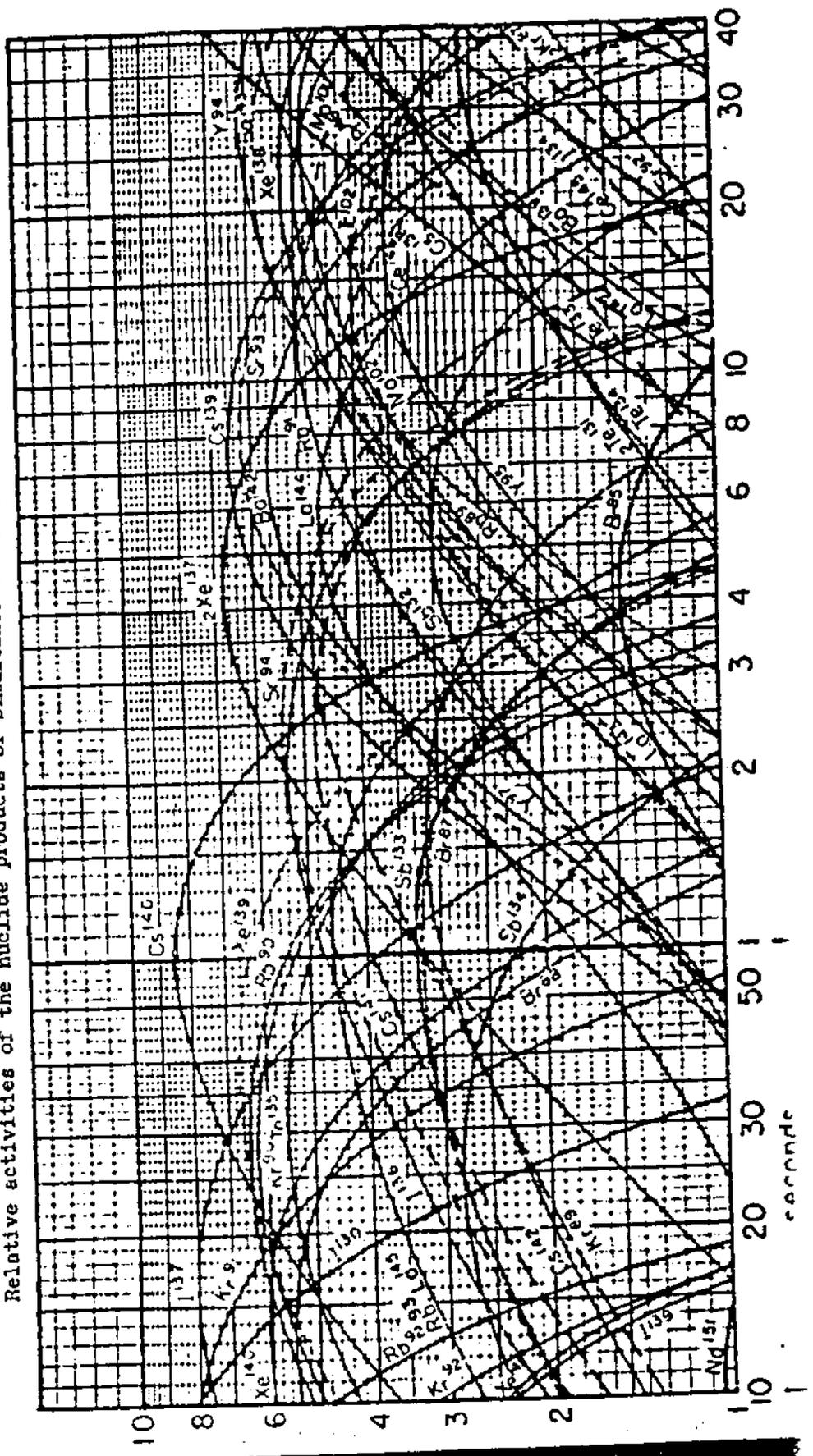
CALCULATION PROCEDURE: 
$$\frac{C/m \text{ (VOLUME FACTOR)}}{(\text{Geo.}) (2.2 \times 10^6) (\text{S.S.}) (\text{bs.}) (\text{S.S.A.}) (A + \text{M.W.}) (\text{Yield})} = \mu\text{C/unit}$$

1083828

NUCLEONICS, Vol. 9, 1951  
Relative activities of element products of simultaneous slow-neutron fission of U235.

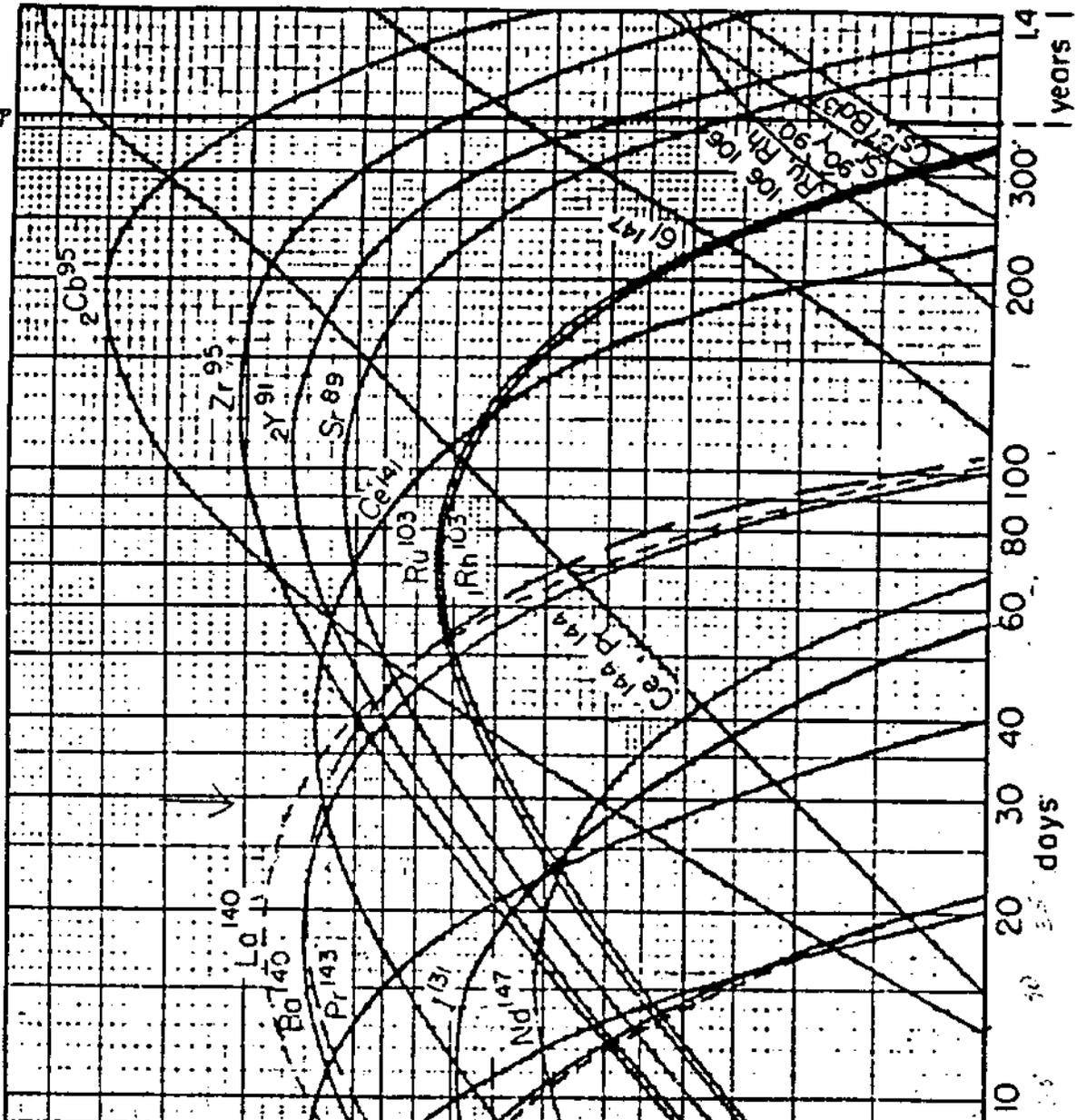


NUCLEONICS, Vol. 9, 1951  
Relative activities of the nuclide products of simultaneous slow-neutron fission of U<sup>235</sup>.



HW-15251-APP

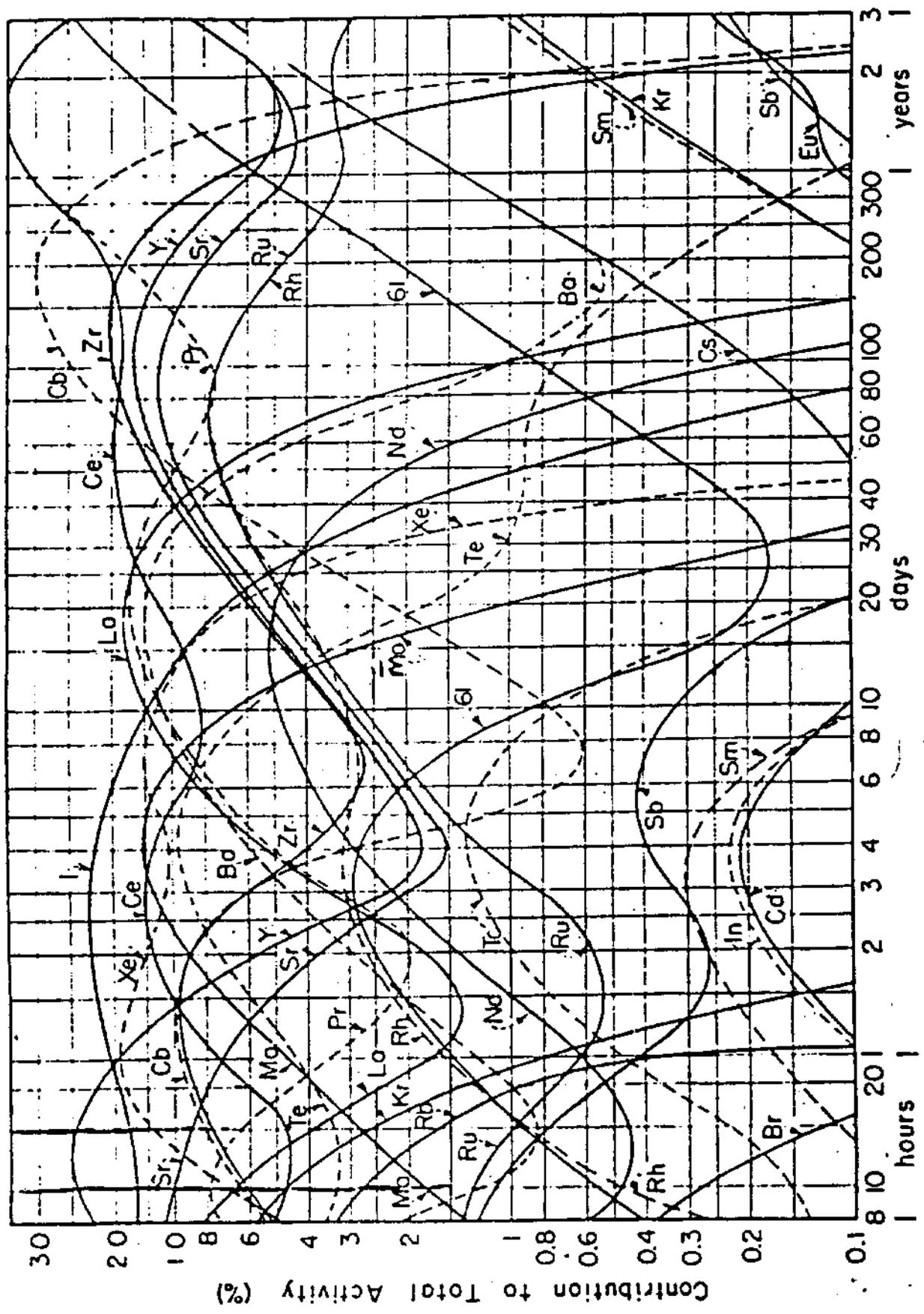
1951  
of the nuclide products of simultaneous slow-neutron fission of U235.



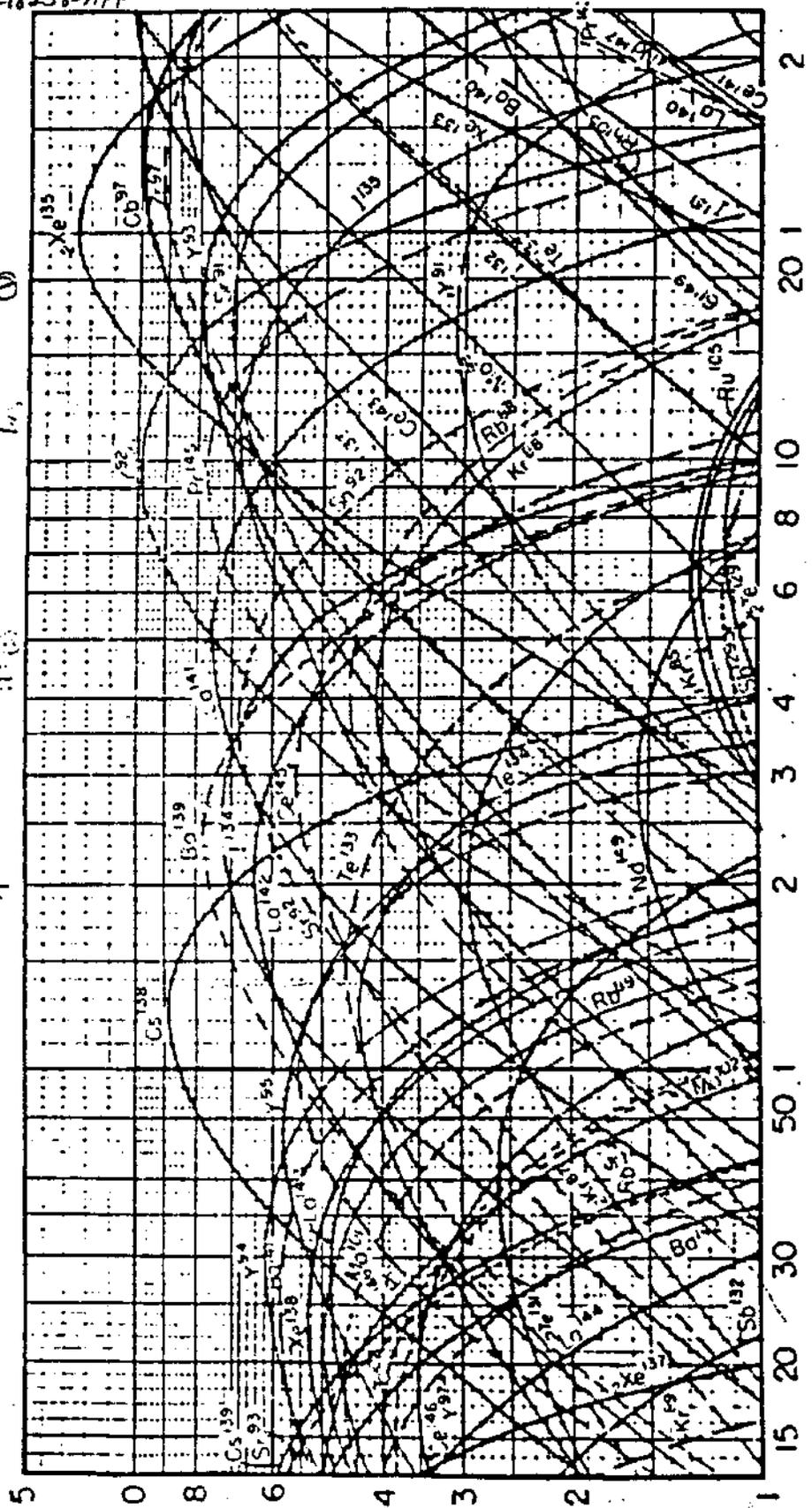


NUCLEONICS, Vol. 9, 1951

Relative activities of element products of simultaneous slow-neutron fission of U235.



NUCLEONICS, Vol. 9, 1951  
Relative activities of the nuclide products of simultaneous slow-neutron fission of U235.



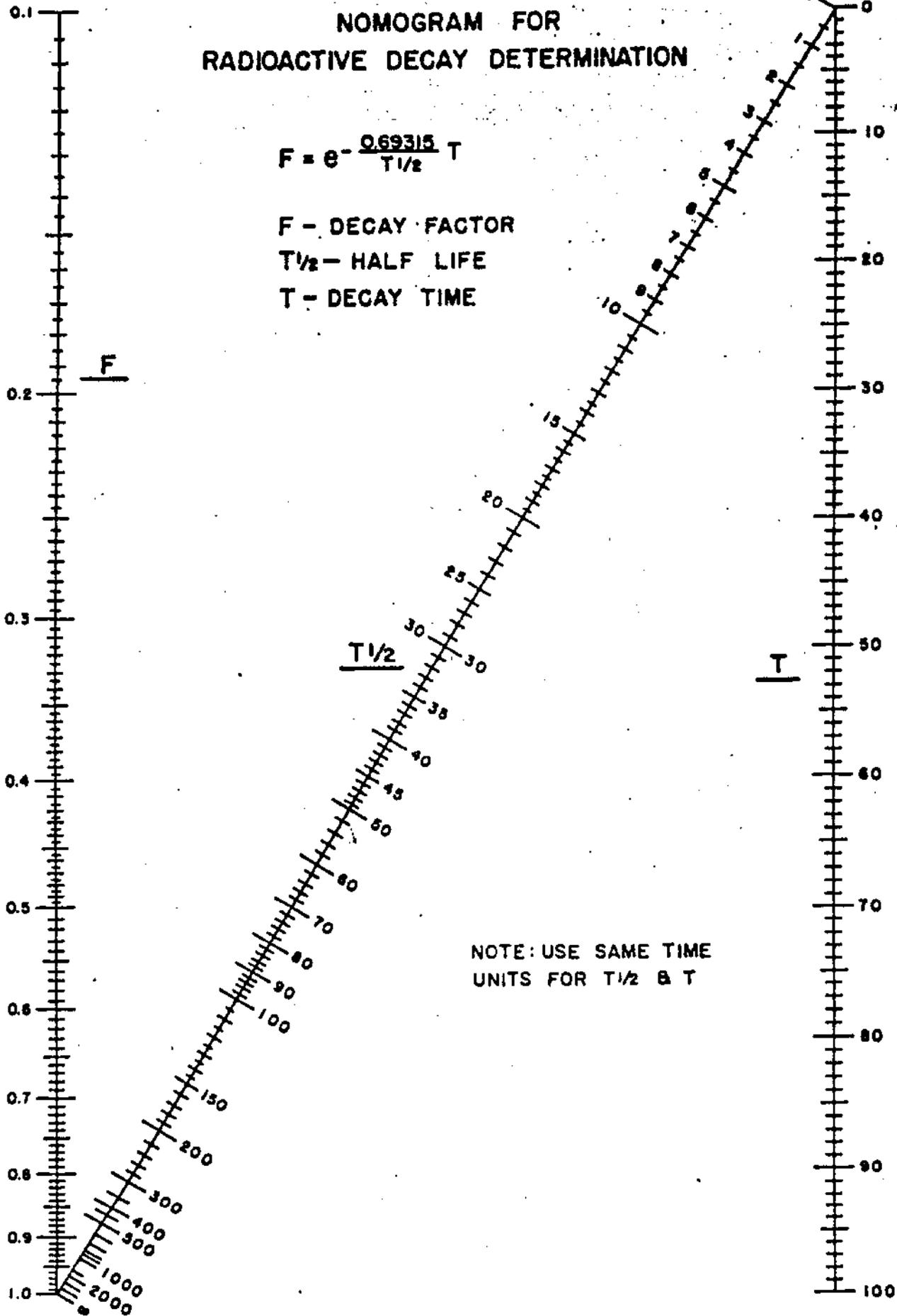
# NOMOGRAM FOR RADIOACTIVE DECAY DETERMINATION

$$F = e^{-\frac{0.69315}{T_{1/2}} T}$$

F - DECAY FACTOR

T<sub>1/2</sub> - HALF LIFE

T - DECAY TIME



NOTE: USE SAME TIME UNITS FOR T<sub>1/2</sub> & T

CALCULATION FACTORS FOR CONVERTING COUNTS/MINUTE

TO UNITS OF 10<sup>-6</sup> uc/ml FOR GIVEN VOLUMES

(REACTOR EFFLUENT STUDIES 1-1-56)

ISOTOPE (A)	SHELF					VOL. (ml)	PREC. (mc/cm <sup>2</sup> )
	1	2	3	4	5		
GROSS BETA	0.79	2.4	5.7	9.8	15.4	2	0
	1.59	4.82	11.4	19.6	30.8	1	0
RARE EARTHS AND YTTERIUM	0.031	0.094	0.22	0.374	0.58	50	7.85
	1.56	4.7	10.9	18.7	29.1	1	7.85
SILICON-31	0.015	0.045	0.103	0.177	0.274	100	10.0
	1.5	4.5	10.3	17.7	27.4	1	10.0
SODIUM-24	0.0145	0.044	0.102	0.174	0.27	100	7.18
	1.45	4.4	10.2	17.4	27	1	7.18
COPPER-64*	0.28	0.91	2.2	4.3	7.1	10	5.1
	2.8	9.1	22	43	71	1	5.1
ARSENIC-76	0.0144	0.043	0.099	0.167	0.257	100	8.15
	1.44	4.3	9.9	16.7	25.7	1	8.15
STRONTIUM (TOTAL)	0.0157	0.048	0.112	0.193	0.304	100	7.9
	1.57	4.8	11.2	19.3	30.4	1	7.9
MANGANESE-56	0.3	0.83	1.76	2.96	4.5	10	3.13
	3	8.3	17.6	29.6	45	1	3.13
BARIUM TOTAL	0.0146	0.043	0.099	0.165	0.254	100	7.4
	1.46	4.3	9.9	16.5	25.4	1	7.4
PHOSPHORUS-32	0.003	0.0091	0.0202	0.0334	0.0509	500	21.95
	1.5	4.55	10.1	16.7	25.4	1	21.95
IODINE (TOTAL)	0.0016	0.0049	0.0113	0.0193	0.03	1000	14.8
	1.6	4.9	11.3	19.3	30	1	14.8
NEPTUNIUM-239	0.095	0.324	0.860	1.68	3.04	25	0
	2.38	8.1	21.4	41.9	76	1	0
Ba <sup>140</sup> / La <sup>140</sup>	0.001	0.0032	0.0074	0.0129	0.0205	1500	7.4
	1.5	4.7	11.1	19.4	30.7	1	7.4
Sr <sup>89</sup> / Sr <sup>90</sup>	0.001	0.0032	0.0074	0.0126	0.0198	1500	7.9
	1.5	4.76	11.1	18.9	29.7	1	7.9
Y <sup>90</sup> (Sr <sup>90</sup> )**	0.0021	0.0062	0.0134	0.0236	0.0364	1500	7.85
	3.15	9.35	20.9	35.5	54.5	1	7.85

\* Multiply by 0.56 to get beta plus positron activity density exclusive of EC

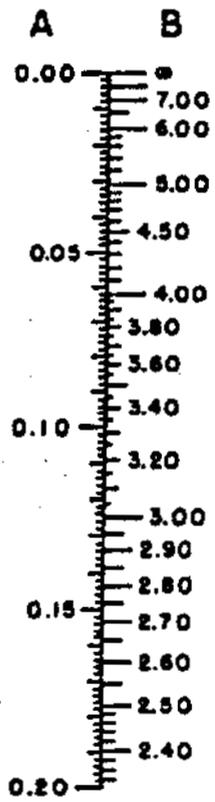
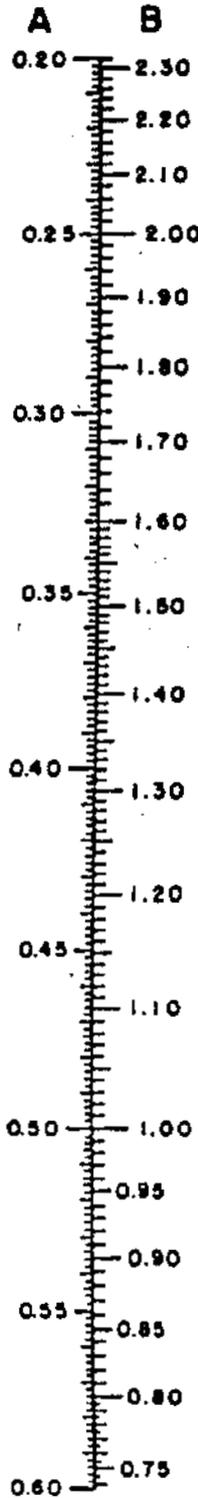
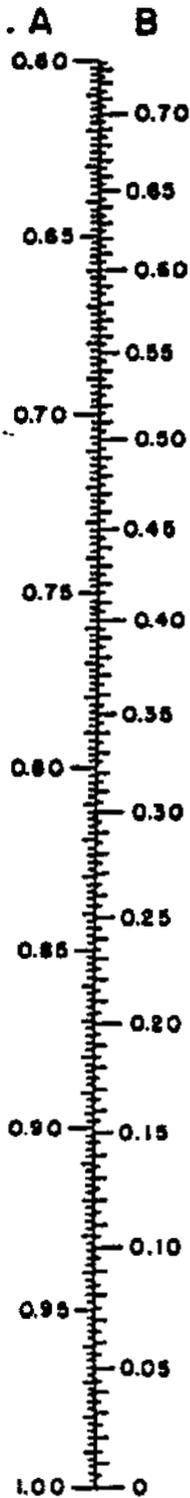
\*\* Divide by 2.0 to get Y<sup>90</sup> exclusively. Factors given are for Sr<sup>90</sup> / Y<sup>90</sup>

# NOMOGRAM FOR RADIOACTIVE DECAY DETERMINATION

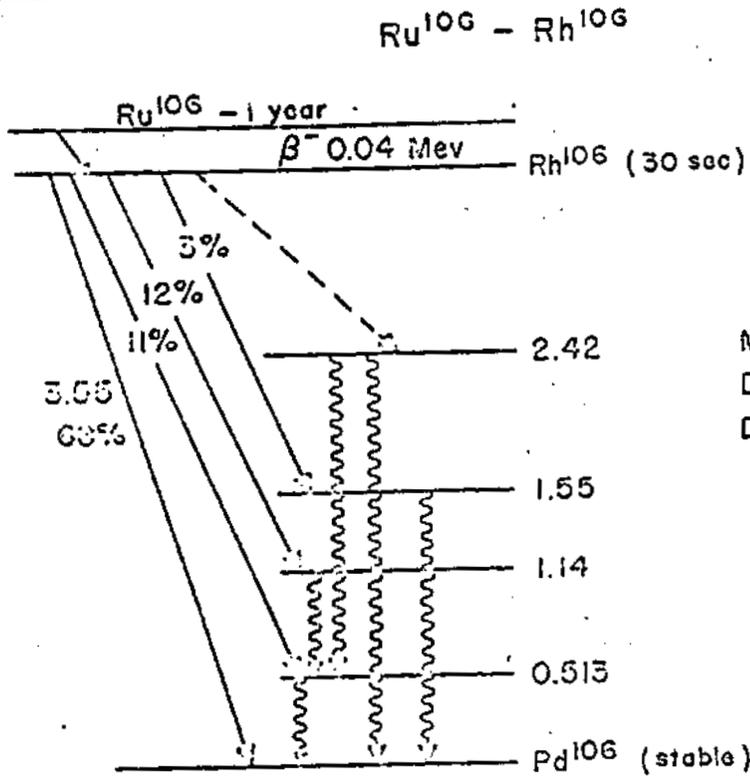
$$A = e^{-0.693158 B}$$

A - DECAY FACTOR

B - DECAY TIME ÷ HALF LIFE

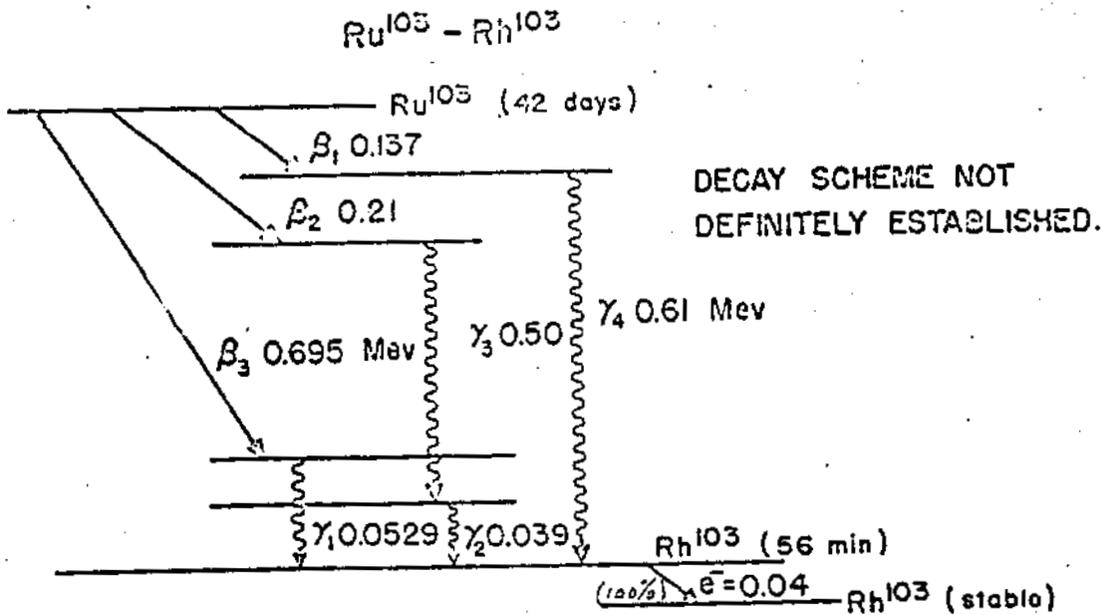


DECAY SCHEME OF RUTHENIUM - RHODIUM ISOTOPES



MOST RECENT SCHEME.  
DECAY SCHEME NOT  
DEFINITELY ESTABLISHED.

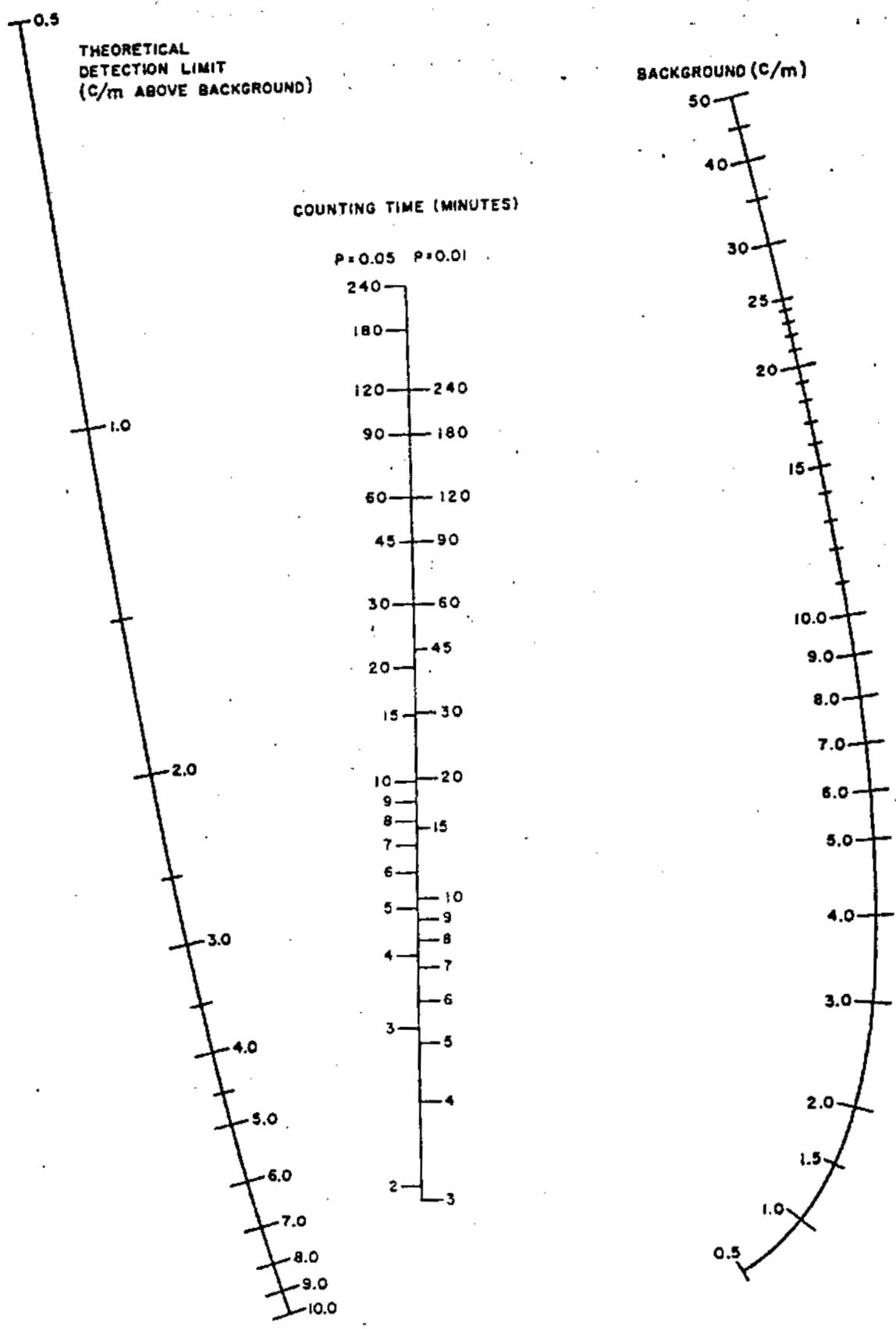
REFERENCE: REVIEW MODERN PHYSICS VOL. 25 No. 2 pp. 469-651



DECAY SCHEME NOT  
DEFINITELY ESTABLISHED.

REFERENCE: PHYSICAL REVIEW MAY 15, 1952 VOL. 86, COPY 2.

# THEORETICAL DETECTION LIMIT NOMOGRAM

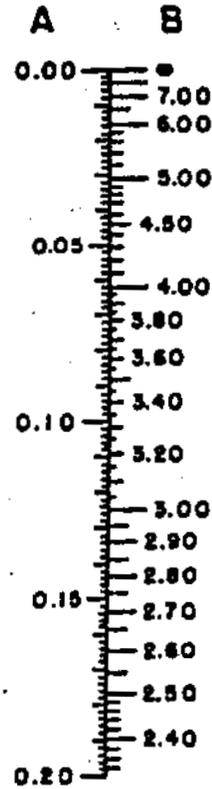
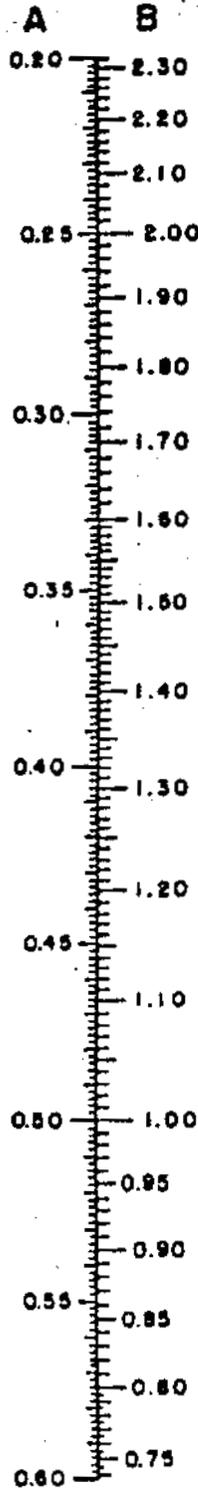
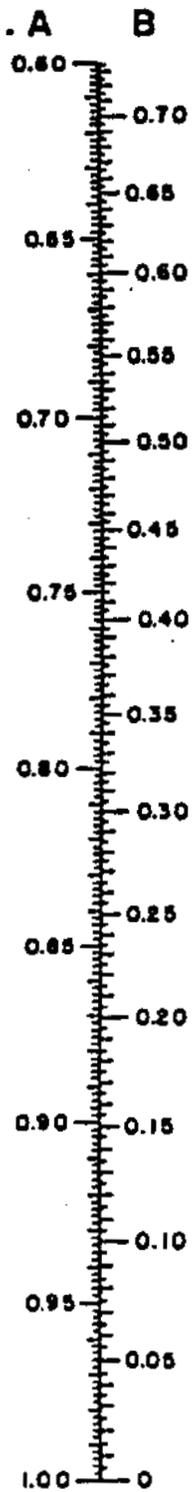


# NOMOGRAM FOR RADIOACTIVE DECAY DETERMINATION

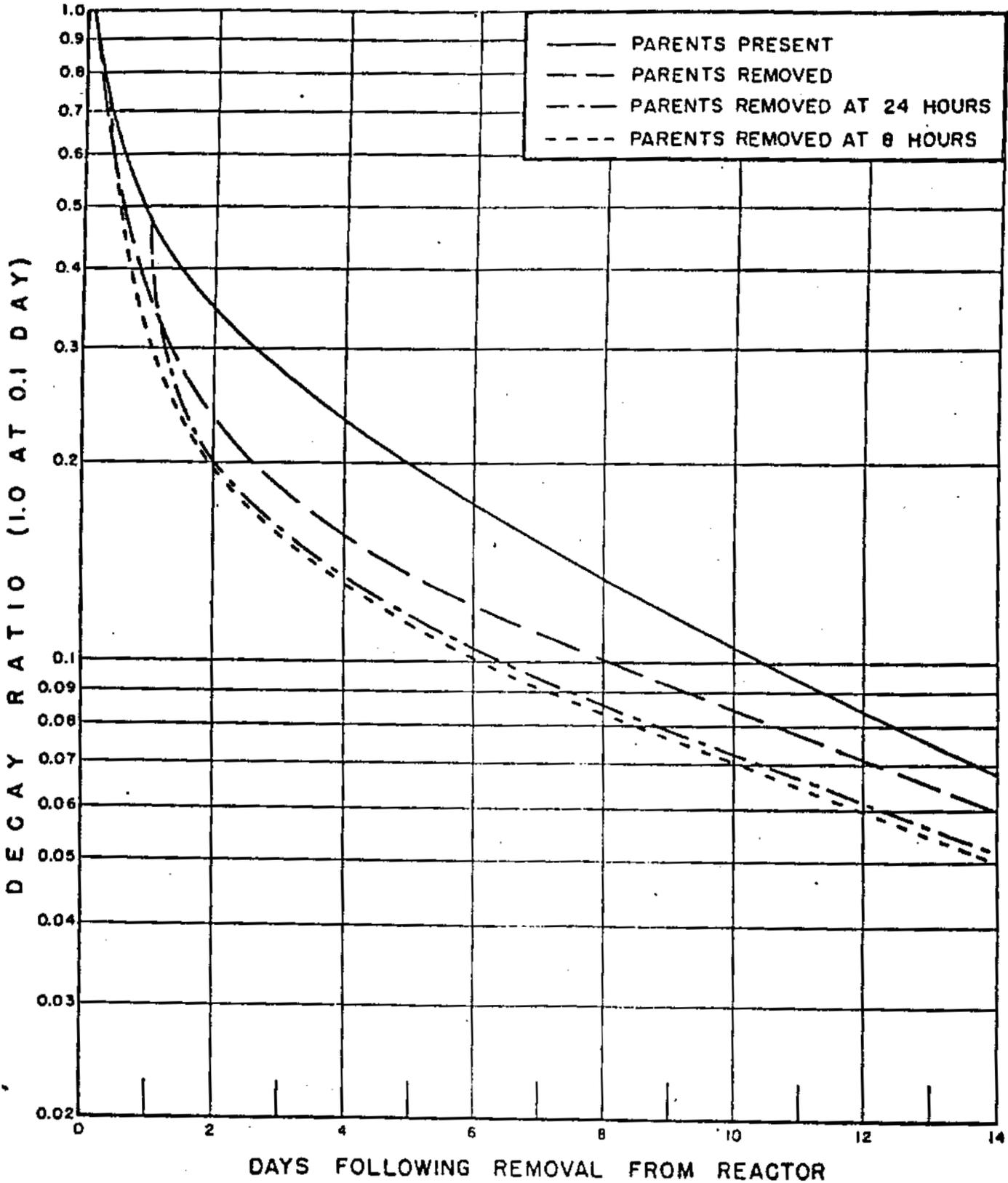
$$A = e^{-0.69315B}$$

A - DECAY FACTOR

B - DECAY TIME ÷ HALF LIFE



### THEORETICAL GROSS IODINE FISSION PRODUCT DECAY (ALL ISOTOPES BUT $^{129}$ AT EQUILIBRIUM)

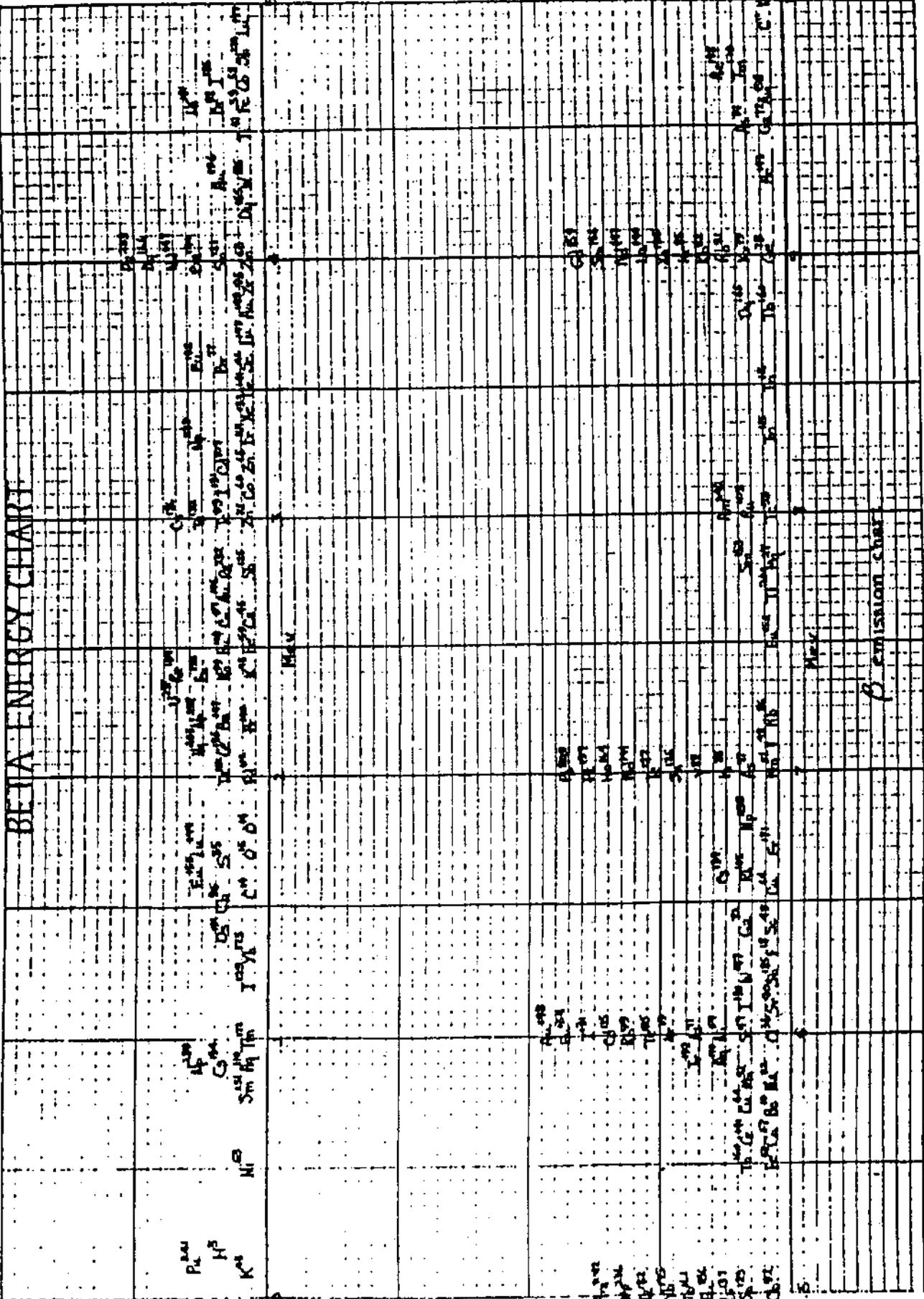


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HALF-LIFE CHART

Year	Month	Day	Time	Location	Activity	Notes
1951	Jan	12	10:00	RA	RA 100	
1951	Jan	15	10:00	RA	RA 100	
1951	Jan	18	10:00	RA	RA 100	
1951	Jan	21	10:00	RA	RA 100	
1951	Jan	24	10:00	RA	RA 100	
1951	Jan	27	10:00	RA	RA 100	
1951	Jan	30	10:00	RA	RA 100	
1951	Feb	2	10:00	RA	RA 100	
1951	Feb	5	10:00	RA	RA 100	
1951	Feb	8	10:00	RA	RA 100	
1951	Feb	11	10:00	RA	RA 100	
1951	Feb	14	10:00	RA	RA 100	
1951	Feb	17	10:00	RA	RA 100	
1951	Feb	20	10:00	RA	RA 100	
1951	Feb	23	10:00	RA	RA 100	
1951	Feb	26	10:00	RA	RA 100	
1951	Feb	29	10:00	RA	RA 100	
1951	Mar	3	10:00	RA	RA 100	
1951	Mar	6	10:00	RA	RA 100	
1951	Mar	9	10:00	RA	RA 100	
1951	Mar	12	10:00	RA	RA 100	
1951	Mar	15	10:00	RA	RA 100	
1951	Mar	18	10:00	RA	RA 100	
1951	Mar	21	10:00	RA	RA 100	
1951	Mar	24	10:00	RA	RA 100	
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1951	Mar	30	10:00	RA	RA 100	
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1083842





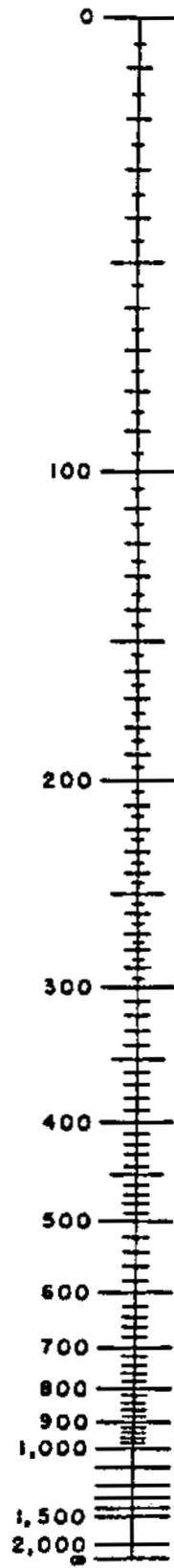
THEORETICAL

RATIO

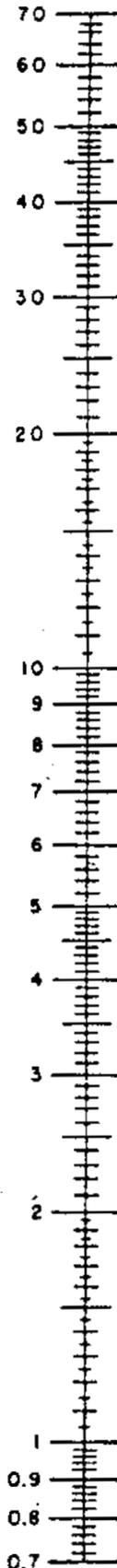
$$\frac{Ru^{103}}{Ru^{106}}$$

ACTIVITY

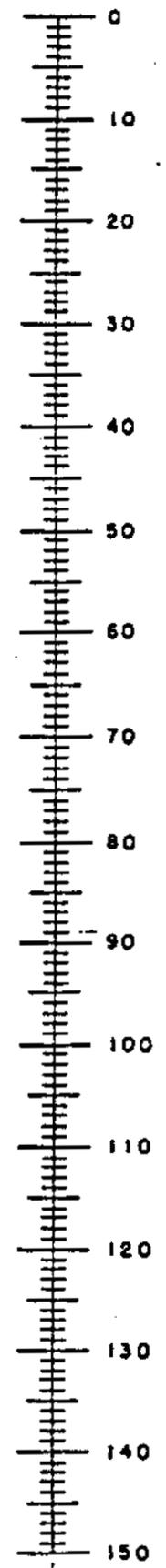
IRRADIATION TIME  
DAYS



RATIO



DECAY TIME  
DAYS



1083845

October 27, 1953

TO: R. S. Analytical Advisory Committee

FROM: L. C. Schwendiman

AREA OF ONE INCH AND ONE AND ONE-HALF INCH  
STANDARD COUNTING DISHES

The actual area occupied by a precipitate when spread on a standard counting dish is a function of the amount of precipitate, surface tension effects, and drying conditions employed. For these reasons it is difficult, if not impossible, to accurately determine the surface density (mg/cm<sup>2</sup>) of residue on a counting dish. This is particularly true of the presently used "one-inch" counting dish which has a generous radius where the sides meet the bottom. The attached scale drawings of the cross section of the dishes and tables illustrate the degree to which the area is dependent upon the depth of material on the plate if it is assumed that the solid material can be placed on the dish with no "creeping" up the walls. A calculation of mg/cm<sup>2</sup> for precipitate of varying weight and specific gravity was made and these values appear in the tables. From these data it is easily seen that significant variation will occur even when surface tension effects are ignored.

A series of plates was prepared by transferring precipitated CaC<sub>2</sub>O<sub>4</sub>, AgCl, Al(OH)<sub>3</sub>, and BaCO<sub>3</sub> prepared by precipitating 20 mg of the cation in each instance. The precipitates were slurried in the usual manner and dried under a lamp. The diameter of the circle to which the precipitate advanced was measured and the area calculated. In the case of AgCl and Al(OH)<sub>3</sub> this area would have little actual significance, since upon drying, the precipitate contracted and finally formed small heavy deposits with regions not covered by any precipitate. The CaC<sub>2</sub>O<sub>4</sub> and BaCO<sub>3</sub> gave smooth, fairly uniform, symmetrical sources. The average measured area for these precipitates was 10 cm<sup>2</sup> for the 1-1/2" plates and 4.5 cm<sup>2</sup> for the one-inch plates. These areas are larger than the tabled values and reflect the

extent to which a precipitate may creep into the radius at the bottom of the plate.

As pointed out in the first paragraph, however, it is to be expected that each precipitate will have its own drying characteristics, which in turn will be influenced by acid content, temperature and time of drying. For these reasons it is advised that in every possible case self absorption measurements be made using the plate size which will be used in the analytical determination of the isotope in question, and that the same conditions be maintained as will be used in the determination. It is further recommended that in presenting the self absorption data graphically that,

1. The abscissa be plotted as weight in mg on the plate which will be clearly identified as one-inch dish, 1-1/2 inch dish, or 1-1/2 inch filter paper, etc., or,
2. The abscissa be plotted as mg/cm<sup>2</sup>, the plate description given, and the nominal plate area used to convert total weight to mg/cm<sup>2</sup> be clearly stated.

To insure uniformity in utilizing self absorption data obtained in a manner different from that in which it must be applied the following nominal areas will be used:

For one-inch dishes, 4.5 cm<sup>2</sup>.

For 1-1/2 inch dishes, 10.0 cm<sup>2</sup>

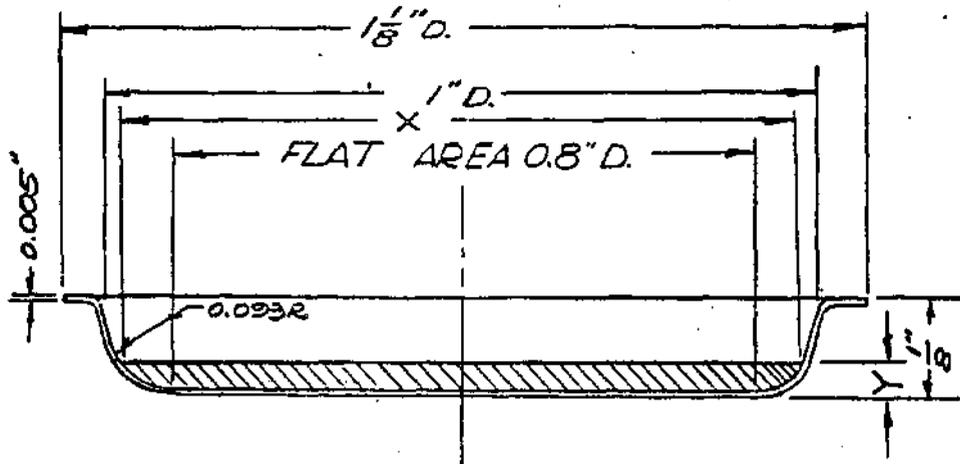
For filter papers and discs use actual measured area of precipitate.

These areas will approach those actually achieved for weights of precipitates commonly employed, however, they must be used with recognition of limitations enumerated above.

*L. C. Schwendiman*  
L. C. Schwendiman  
Radiochemical Standards

LCS:R

CROSS SECTION THROUGH STD. "ONE-INCH"  
COUNTING DISH



"Y" (IN.)	"X" (IN.)	"A" AREA AT Y (CM <sup>2</sup> )	PPT. SP. GR. = 1		PPT. SP. GR. = 3		PPT. SP. GR. = 5	
			WT.(MG) ON DISH	WT. A	WT.(MG) ON DISH	WT. A	WT.(MG) ON DISH	WT. A
0	0.800	3.24	0.00	0.00	0.000	0.000	0.00	0.00
0.001	0.827	3.46	8.78	2.54	26.34	7.62	43.90	12.70
0.002	0.838	3.57	17.85	5.00	53.55	15.00	89.25	25.00
0.005	0.860	3.75	46.42	12.37	139.3	37.11	232.1	61.85
0.010	0.884	3.96	95.44	24.10	286.3	72.30	477.2	120.5
0.020	0.915	4.24	199.6	47.07	598.8	141.2	998.0	235.3
0.030	0.936	4.44	309.8	69.77	929.4	209.3	1549	348.9
0.040	0.953	4.59	424.3	92.44	1273	277.3	2121	462.2
0.050	0.965	4.71	542.4	115.1	1627	345.	2712	575.5

SP. GR. BaCO<sub>3</sub> = 4.29

Lo<sub>2</sub>O<sub>3</sub> = 6.51

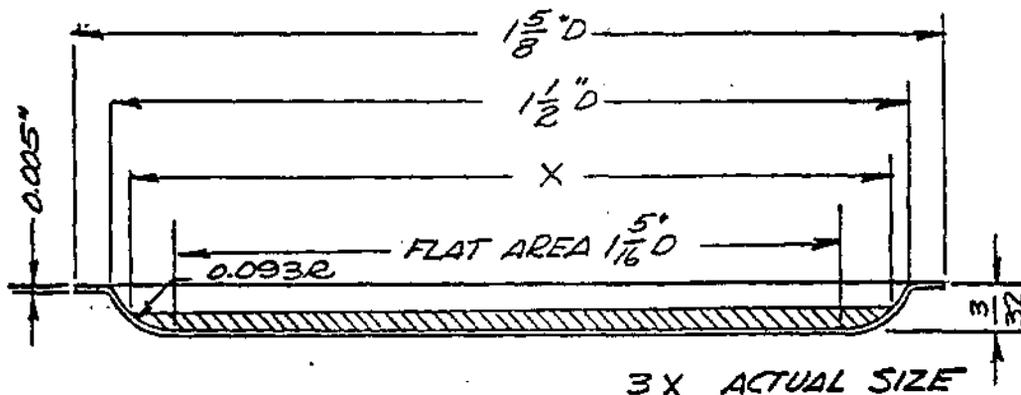
AgCl = 5.56

CsClO<sub>4</sub> = 3.32

MnO<sub>2</sub> = 5.03

CeF<sub>3</sub> = 5.8

CROSS SECTION THROUGH  
STD. "1 1/2" INCH COUNTING DISH.



"Y" (IN.)	"X" (IN.)	AREA AT "Y" (CM <sup>2</sup> )	PPT. SP. GR. = 1.		PPT. SP. GR. = 3.		PPT. SP. GR. = 5.	
			WT (MG) ON DISH	WT Δ	WT (MG) ON DISH	WT Δ	WT (MG) ON DISH	WT Δ
000	1.312	8.72	—	—	—	—	—	—
0001	1.339	9.07	23.0	2.54	69.0	7.62	115	12.70
0002	1.360	9.23	46.4	5.03	139.2	15.09	232	25.15
0.005	1.372	9.54	117.6	12.33	352.8	36.99	588	61.65
0010	1.396	9.87	240.8	24.40	722.4	73.20	1204	122.0
0020	1.427	10.30	496.1	48.16	1488	144.8	2480	240.8
0030	1.448	10.62	761.8	71.73				
0040	1.465	10.86	1035	95.30				
0050	1.477	11.03						