LAMPIRAN A

(PERHITUNGAN RALAT)

A.1. Perhitungan Laju Cacah

$$\text{Laju cacah (cps)} = \frac{\text{NET (cacah bersih)}}{\text{Lama pencacahan (detik)}}$$

$$\text{Rata-rata } (\bar{X}) = \frac{\sum X}{k} \; ; k = 3$$

$$\text{Standar deviasi } (S_{\bar{x}}) = \sqrt{\frac{\sum (X_i - \bar{X})^2}{k(k-1)}}$$

Tabel 6.1 Perhitungan laju cacah (cps) K-40

No	Sandi	$X_1 (10^{-3})$	$X_2 (10^{-3})$	$X_3 (10^{-3})$	$\bar{x} (10^{-3})$	$S_{\bar{x}} (10^{-3})$
1.	I A	8,0	8,5	7,0	7,8	0,5
2.	I B	6,5	7,0	5,5	6,3	0,5
3.	I C	5,5	7,0	5,5	6,0	0,5
4.	I D	4,0	4,0	3,0	3,6	0,3
5.	II A	2,5	3,0	2,5	2,7	0,5
6.	II B	3,5	5,0	3,5	4,0	0,5
7.	II C	4,0	4,0	4,0	4,0	0,0
8.	II D	3,5	4,5	3,0	3,7	0,5
9.	III A	4,0	4,5	3,0	3,8	0,5
10.	III B	2,0	2,5	2,0	2,2	0,5
11.	III C	2,0	3,0	2,5	2,5	0,3
12.	III D	4,0	4,0	5,0	4,5	0,3

Tabel 6.2. Perhitungan laju cacah (cps) Tl-208

No	Sandi	$X_1 (10^{-3})$	$X_2 (10^{-3})$	$X_3 (10^{-3})$	$\bar{x} (10^{-3})$	$S_{\bar{x}} (10^{-3})$
1.	I A	3,5	2,0	3,0	3,8	0,5
2.	I C	4,5	5,0	5,5	5,0	0,3
3.	II C	2,5	1,5	3,5	2,5	0,6
4.	II D	2,5	2,5	3.0	2,7	0,5
5.	III B	6,0	4,5	6,0	5,5	0,5
6.	III C	3,5	2,0	4,5	3,3	0,5

A.2. Perhitungan Aktivitas (Bq)

Aktivitas = cps / Y(E) ε(E)

Rata-rata $(\bar{X}) = \frac{\sum X}{k}$; k = 3

Standar deviasi $(S_{\bar{X}}) = \sqrt{\frac{\sum (X_i - \bar{X})^2}{k(k-1)}}$

Tabel 6.3. Perhitungan aktivitas K-40

No	Sandi	X_1	X_2	X_3	$\bar{X}$	$S_{\bar{X}}$
1.	I A	7,48	7,94	6,54	7,32	0,42
2.	I B	6,07	6,54	5,14	5,92	0,43
3.	I C	5,14	6,54	5,14	5,61	0,47
4.	I D	3,74	3,74	2,80	3,43	0,31
5.	II A	2,34	2,80	2,34	2,49	0,15
6.	II B	3,27	4,67	3,27	3,74	0,47
7.	II C	3,74	3,74	3,74	3,74	0,00
8.	II D	3,27	4,21	2,80	3,41	0,46
9.	III A	3,74	4,21	2,80	3,58	0,41
10.	III B	1,87	2,34	1,87	2,03	0,16
11.	III C	1,87	2,88	2,34	2,34	0,27
12.	III D	3,74	4,21	4,67	4,21	0,27

Tabel 6.4. Perhitungan aktivitas Tl-208

No	Sandi	X_1	X_2	X_3	$\bar{X}$	$S_{\bar{X}}$
1.	I A	0,20	0,12	0,17	0,16	0,02
2.	I C	0,26	0,29	0,32	0,29	0,02
3.	II C	0,14	0,09	0,20	0,14	0,03
4.	II D	0,14	0,14	0,17	0,15	0,01
5.	III B	0,35	0,26	0,35	0,32	0,02
6.	III C	0,20	0,12	0,26	0,19	0,04

A.3. Perhitungan Jumlah Atom

Jumlah atom (N) = AT/ ln 2

A = Aktivitas (Bq) ; T = Waktu paruh (detik)

Rata-rata $(\bar{X}) = \frac{\sum X}{k}$; k = 3

Standar deviasi $(S_{\bar{x}}) = \sqrt{\frac{\sum (X_i - \bar{X})^2}{k(k-1)}}$

Tabel 6.5. Perhitungan jumlah atom K-40

No	Sandi	X_1 (10^{17})	X_2(10^{17})	X_3(10^{17})	$\bar{x}$(10^{17})	$S_{\bar{x}}$ (10^{17})
1.	I A	4,36	4,63	3,81	4,27	0,24
2.	I B	3,54	3,81	2,30	3,22	0,46
3.	I C	2,30	3,81	2,30	2,80	0,50
4.	I D	2,18	2,18	1,63	1,30	0,28
5.	II A	1,36	1,63	1,36	1,45	0,09
6.	II B	1,91	2,72	1,91	2,18	0,27
7.	II C	2,18	2,18	2,18	2,18	0,00
8.	II D	1,91	2,45	1,63	1,30	0,55
9.	III A	2,18	2,45	1,63	2,09	0,24
10.	III B	1,09	1,36	1,09	1,18	0,09
11.	III C	1,09	1,63	1,36	1,36	0,16
12.	III D	2,18	2,45	2,72	2,45	0,16

Tabel 6.6. Perhitungan jumlah atom Tl-208

No	Sandi	X_1	X_2	X_3	$\bar{x}$	$S_{\bar{x}}$
1.	I A	53,68	32,21	45,63	43,84	6,26
2.	I C	69,78	77,83	85,89	77,83	4,65
3.	II C	37,58	24,16	53,68	38,47	8,53
4.	II D	37,58	37,58	45,63	52,79	9,25
5.	III B	93,94	69,78	93,94	85,89	8,05
6.	III C	53,68	32,21	69,78	51,89	10,88

A.4. Perhitungan Massa Isotop (gr)

Massa isotop (W) = NM/6,02 x 10^{23}

N = Jumlah isotop ; M = Berat atom isotop (K=39,1 ; Tl=204,4)

Rata-rata $(\overline{X}) = \frac{\sum X}{k}$; k = 3

Standar deviasi $(S_{\overline{X}}) = \sqrt{\frac{\sum (X_i - \overline{X})^2}{k(k-1)}}$

Tabel 6.7. Perhitungan massa isotop K-40

No	Sandi	$X_1 (10^{-5})$	$X_2 (10^{-5})$	$X_3 (10^{-5})$	$\overline{x} (10^{-5})$	$S_{\overline{x}}$ (10^{-5})
1.	I A	2,83	3,01	2,47	2,77	0,33
2.	I B	2,30	2,47	1,49	2,09	0,30
3.	I C	1,49	2,47	1,49	1,82	0,33
4.	I D	1,42	1,42	1,06	1,30	0,12
5.	II A	0,88	1,06	0,88	0,94	0,06
6.	II B	1,24	1,77	1,224	1,42	0,18
7.	II C	1,42	1,42	1,42	1,42	0,00
8.	II D	1,24	1,59	1,06	1,30	0,16
9.	III A	1,42	1,59	1,06	1,36	0,16
10.	III B	0,71	0,88	0,71	0,77	0,06
11.	III C	0,71	1,06	0,88	0,88	0,10
12.	III D	1,42	1,59	1,77	1,59	0,10

Tabel 6.8. Perhitungan massa isotop Tl-208

No	Sandi	$X_1 (10^{-20})$	$X_2 (10^{-20})$	$X_3 (10^{-20})$	$\overline{x} (10^{-20})$	$S_{\overline{x}}$ (10^{-20})
1.	I A	1,82	1,09	1,55	1,49	0,35
2.	I C	2,37	2,64	2,92	2,64	0,16
3.	II C	1,28	0,82	1,82	1,23	0,29
4.	II D	1,28	1,28	1,55	1,37	0,27
5.	III B	3,19	2,37	3,19	2,92	0,27
6.	III C	1,82	1,09	2,37	1,58	0,42

A.5. Perhitungan Aktivitas Konversi (Bq/gr)

Aktivitas konversi rata-rata $(\overline{K}) = \overline{A}/\overline{M}$

$\overline{A}$ = Aktivitas rata-rata (Bq) ; $\overline{M}$ = Massa cuplikan rata-rata (gr).

Ralat rambat :

$$\frac{\partial \overline{K}}{\partial \overline{A}} = \frac{1}{\overline{M}} \quad ; \quad \frac{\partial \overline{K}}{\partial \overline{M}} = -\frac{\overline{A}}{\overline{M}^2}$$

$$S_{\overline{K}} = \left[\left(\frac{\partial \overline{K}}{\partial \overline{A}}\right)^2 S_{\overline{A}}{}^2 + \left(\frac{\partial \overline{K}}{\partial \overline{M}}\right)^2 S_{\overline{M}}{}^2\right]^{1/2} = \left[\left(\frac{1}{\overline{M}}\right)^2 S_{\overline{A}}{}^2 + \left(-\frac{\overline{A}}{\overline{M}^2}\right)^2 S_{\overline{M}}{}^2\right]^{1/2}$$

Tabel 6.9. Perhitungan Aktivitas konversi K-40

No	Sandi	$\overline{A}$ (Bq)	$S_{\overline{A}}$ (Bq)	$\overline{M}$ (gr)	$S_{\overline{M}}$ (gr)	$\overline{K}$ (10^{-1}) (Bq/gr)	$S_{\overline{K}}$ (10^{-1}) (Bq/gr)
1.	I A	7,32	0,42	15,02	0,01	4,87	0,27
2.	I B	5,92	0,43	15,04	0,01	3,94	0,29
3.	I C	5,61	0,47	15,04	0,01	3,73	0,31
4.	I D	3,43	0,31	20,03	0,01	1,71	0,15
5.	II A	2,49	0,15	15,05	0,01	1,65	0,10
6.	II B	3,74	0,47	15,01	0,01	2,49	0,31
7.	II C	3,74	0,00	15,06	0,01	2,48	0,11
8.	II D	3,41	0,46	20,02	0,01	1,70	0,23
9.	III A	3,58	0,41	15,01	0,01	2,38	0,27
10.	III B	2,03	0,16	15,04	0,01	1,35	0,10
11.	III C	2,34	0,27	15,02	0,01	1,56	0,18
12.	III D	4,21	0,27	20,03	0,01	2,10	0,13

Tabel 6.10. Perhitungan aktivitas konversi Tl-208

No	Sandi	$\overline{A}$ (Bq)	$S_{\overline{A}}$ (Bq)	$\overline{M}$ (gr)	$S_{\overline{M}}$ (gr)	$\overline{K}$ (10^{-2}) (Bq/gr)	$S_{\overline{K}}$ (10^{-2}) (Bq/gr)
1.	I A	0,16	0,02	15,02	0,01	1,06	0,13
2.	I C	0,29	0,02	15,04	0,01	1,93	0,14
3.	II C	0,14	0,03	15,06	0,01	0,93	0,20

4.	II D	0,15	0,01	20,02	0,01	0,75	0,05
5.	III B	0,32	0,02	15,04	0,01	2,13	0,14
6.	III C	0,19	0,04	15,02	0,01	1,26	0,27

Keterangan :

$\overline{A}$ = Aktivitas rata-rata (Bq). $\overline{M}$ = Massa cuplikan rata-rata (gr).

$S_{\overline{A}}$ = Standar deviasi aktivitas (Bq). $S_{\overline{M}}$ = Standar deviasi massa cuplikan (gr)

$\overline{K}$ = Aktivitas konversi rata-rata (Bq/gr). $S_{\overline{K}}$ = Ralat rambat aktivitas konversi (Bq/gr).

A.6. Perhitungan Kadar Isotop

Kadar isotop rata-rata $(\overline{k}) = \overline{m}/\overline{M}$

$\overline{m}$ = Massa isotop rata-rata ; $\overline{M}$ = Massa cuplikan rata-rata.

Ralat rambat :

$$\frac{\partial \overline{k}}{\partial \overline{m}} = \frac{1}{\overline{M}} \quad ; \quad \frac{\partial \overline{k}}{\partial \overline{M}} = -\frac{\overline{m}}{\overline{M}^2}$$

$$S_{\overline{K}} = \left[\left(\frac{\partial \overline{k}}{\partial \overline{m}}\right)^2 S_{\overline{m}}^{\,2} + \left(\frac{\partial \overline{k}}{\partial \overline{M}}\right)^2 S_{\overline{M}}^{\,2}\right]^{1/2} = \left[\left(\frac{1}{\overline{M}}\right)^2 S_{\overline{m}}^{\,2} + \left(-\frac{\overline{m}}{\overline{M}^2}\right)^2 S_{\overline{M}}^{\,2}\right]^{1/2}$$

Tabel 6.11. Perhitungan kadar isotop K-40

No	Sandi	$\overline{m}$ (gr)	$S_{\overline{m}}$ (gr)	$\overline{M}$ (gr)	$S_{\overline{M}}$ (gr)	$\overline{K}$ $(10^{-6})(\%)$	$S_{\overline{K}}$ $(10^{-6})(\%)$
1.	I A	2,77	0,33	15,02	0,01	1,84	0,22
2.	I B	2,09	0,30	15,04	0,01	1,39	0,63
3.	I C	1,82	0,33	15,04	0,01	1,21	0,22
4.	I D	1,30	0,12	20,03	0,01	0,65	0,06
5.	II A	0,94	0,06	15,05	0,01	0,62	0,04
6.	II B	1,42	0,18	15,01	0,01	0,95	0,12
7.	II C	1,42	0,00	15,06	0,01	0,94	0,01
8.	II D	1,30	0,16	20,02	0,01	0,65	0,28
9.	III A	1,36	0,16	15,01	0,01	0,91	0,11
10.	III B	0,77	0,06	1504	0,01	0,51	0,04

11.	III C	0,88	0,10	15,02	0,01	0,59	0,07
12.	III D	1,59	0,10	20,03	0,01	0,79	0,05

Tabel 6.12. Perhitungan kadar isotop Tl-208

No	Sandi	$\bar{m}$ (gr)	$S_{\bar{m}}$ (gr)	$\bar{M}$ (gr)	$S_{\bar{M}}$ (gr)	$\bar{K}$ (10^{-22})(%)	$S_{\bar{K}}$ (10^{-22})(%)
1.	I A	1,49	0,35	15,02	0,01	9,92	2,32
2.	I C	2,64	0,16	15,04	0,01	17,55	1,06
3.	II C	1,23	0,29	15,06	0,01	8,17	1,92
4.	II D	1,37	0,27	20,02	0,01	6,84	1,35
5.	III B	2,92	0,27	15,04	0,01	19,41	1,79
6.	III C	1,58	0,42	15,02	0,01	10,52	2,79

A.7. Perhitungan Faktor Bioakumulasi

Kosentrasi radionuklida dalam kerang (Bq/gr)

C_k (Bq/gr) = Aktivitas konversi (Bq/gr)

Kosentrasi radionuklida dalam air (Bq/lt)

$$\bar{C}_a = \frac{\bar{B}.\bar{A}}{2.\bar{M}}$$

$\bar{A}$ = Aktivitas rata-rata(Bq).

$\bar{M}$ = Massa cuplikan rata-rata(gr).

$\bar{B}$ = Massa cuplikan setelah dipreparasi (gr).

Ralat rambat :

$$\frac{\partial \overline{C_a}}{\partial \overline{A}} = \frac{\overline{B}}{.2\overline{M}} \qquad \frac{\partial \overline{C_a}}{\partial \overline{B}} = \frac{\overline{A}}{2.\overline{M}} \qquad \frac{\partial \overline{C_a}}{\partial \overline{M}} = -\frac{\overline{B}.\overline{A}}{.2\overline{M}^2}$$

$$S_{\overline{C_a}} = \left[\left(\frac{\overline{B}}{.2\overline{M}} \right)^2 S_{\overline{A}}{}^2 + \left(\frac{\overline{A}}{2.\overline{M}} \right)^2 S_{\overline{B}}{}^2 + \left(-\frac{\overline{B}.\overline{A}}{.2\overline{M}^2} \right)^2 S_{\overline{M}}{}^2 \right]^{1/2}$$

Tabel. 6.14. Perhitungan konsentrasi K-40 di dalam air

No	Sandi	$\overline{A}$ (Bq)	$S_{\overline{A}}$ (Bq)	$\overline{B}$ (gr)	$S_{\overline{B}}$ (gr)	$\overline{M}$ (gr)	$S_{\overline{M}}$ (gr)	$\overline{C}_a$ (Bq/lt)	$S\overline{C}_a$ (Bq/lt)
1.	I D	3,43	0,37	35,37	0,01	20,03	0,01	2,95	0,27
2.	II D	3,41	0,46	57,62	0,02	20,02	0,01	4,91	0,66
3.	III D	4,21	0,27	58,98	0,01	20,03	0,01	6,20	0,40

Tabel. 6.15 Perhitungan konsentrasi Tl-208 di dalam air

No	Sandi	$\overline{A}$ (Bq)	$S_{\overline{A}}$ (Bq)	$\overline{B}$ (gr)	$S_{\overline{B}}$ (gr)	$\overline{M}$ (gr)	$S_{\overline{M}}$ (gr)	$\overline{C}_a$ (10^{-2}) (Bq/lt)	$S\overline{C}_a$ (10^{-2}) (Bq/lt)
1.	II D	0,15	0,01	57,62	0,02	20,02	0,01	21,59	0,02

Keterangan :

$\overline{A}$ = Aktivitas rata-rata (Bq)
$S_{\overline{A}}$ = Standar deviasi aktivitas
$\overline{B}$ = Massa rata-rata cuplikan hasil preparasi (gr)
$S_{\overline{B}}$ = Standar deviasi massa hasil preparasi
$\overline{M}$ = Massa rata-ratacuplikan (gr)
$S_{\overline{M}}$ = Standar deviasi massa cuplikan
$\overline{C}_a$ = Konsentrasi isotop di air(Bq/lt)
$S\overline{C}_a$ = Ralat rambat konsentrasi di air

Faktor bioakumulasi

$$\overline{F} = \frac{\overline{C_k}}{C_a}$$

Ralat rambat :

$$\frac{\partial \overline{F_B}}{\partial C_k} = \frac{1}{C_a} \qquad \frac{\partial \overline{F_B}}{\partial C_a} = -\frac{\overline{C_k}}{C_k{}^2}$$

$$S_{\overline{F_B}} = \left[\left(\frac{1}{\overline{C_a}} \right)^2 S_{\overline{C_k}}^{\ 2} + \left(-\frac{\overline{C_k}}{\overline{C_a}^{\ 2}} \right)^2 S_{\overline{C_a}}^{\ 2} \right]^{1/2}$$

Keterangan :

$\overline{C}_k$ = konsentrasi isotop dalam kerang

$S\overline{C}_k$ = Ralat rambat $\overline{C}_k$

$\overline{C}_a$ = Konsentrasi isotop dalam air

$\overline{F}_B$ = Faktor bioakumulasi

$S\overline{F}_B$ = Ralat rambat $\overline{F}_B$

$S\overline{C}_a$ = Ralat rambat $\overline{C}_a$

Perhitungan ralat rambat faktor bioakumulasi seperti pada tabel 4.9 dan tabel 4.10

LAMPIRAN B

(TABEL ISOTOP, ERDTMAN DAN SOYKA, 1979)

```
1.11050    5.00000 R
1.20510   17.00000 R
1.31150    3.00000 R
1.31330 PAIR PEAK
1.32350 PAIR PEAK
1.37050   19.00000 R
1.44000   39.00000 R
1.45900 PAIR PEAK
1.82430 PAIR PEAK
1.83450 PAIR PEAK
1.86660   10.00000 R
1.97000 PAIR PEAK
2.33530   11.00000 R
2.34550   28.00000 R
2.48100    7.00000 R
2.89270    1.00000 R

-------------------------
 18 AR  44
-------------------------
HALF LIFE:          11.9M
GEN: PHO CA 48
DAU:  K 44
PAR:
REF: 70 HU 2

 0.18230   99.00000 R
 0.40630    8.00000 R
 0.42760    4.00000 R
 0.68270 PAIR PEAK
 0.86470 PAIR PEAK
 1.19370 PAIR PEAK
 1.37570 PAIR PEAK
 1.70470 100.00000 R
 1.88670  50.00000 R

-------------------------
 18 AR  45
-------------------------
HALF LIFE:          21.0S
GEN: CHA CA 48
DAU:  K 45
     CA 45
PAR:
REF: 77 BE 1

 0.47400    1.29200 A
 0.54910    2.68100 A
 1.02009   32.30000 A
 1.10690   11.47000 A
 1.33540 PAIR PEAK
 1.63910    8.59200 A
 1.80858   12.86000 A
 1.84640 PAIR PEAK
 2.35740    7.49400 A
 2.68520 PAIR PEAK
 3.19620 PAIR PEAK
 3.70720   26.07000 A

-------------------------
 19  K  36
-------------------------
HALF LIFE:          0.34S
GEN: CHA AR 36
DAU:
PAR:
REF: 73 EN 1

 0.51100 200.00000 A
 0.94800 PAIR PEAK
 1.18594 PAIR PEAK
 1.41047 PAIR PEAK
 1.45900 PAIR PEAK
 1.69694 PAIR PEAK
 1.92147 PAIR PEAK
 1.97000   84.20000 A
 2.20794   34.40000 A
 2.43247   36.50000 A
 2.46971    3.85000 A
 3.41810 PAIR PEAK
 3.92910 PAIR PEAK
 4.17833    2.15000 A
 4.44010    7.15000 A
 5.58680 PAIR PEAK
 6.09980 PAIR PEAK
 6.61060    6.45000 A

-------------------------
 19  K  37
-------------------------
HALF LIFE:          1.23S
GEN: CHA CL 35
     CHA AR 36
DAU: AR 37
PAR:
REF: 73 EN 1

 0.51100 200.00000 A
 0.57860    0.04000 A
 2.21730    0.04000 A
 2.79590    1.96000 A
 3.60510    0.03400 A

-------------------------
 19  K  38
-------------------------
HALF LIFE:          7.64M
GEN: NFA K  39
     CHA CA 90
     PHO K  39
DAU:
PAR:
REF: 73 EN 1

 0.51100 200.00000 A
 1.14560 PAIR PEAK
 1.65660 PAIR PEAK
 1.76898    0.20000 A
 2.16760 100.00000 A
 3.93658    0.00015 A

-------------------------
 19  X  38M
-------------------------
HALF LIFE:          0.95S
GEN: NFA K  39
     CHA CL 35
     PHO K  39
DAU:
PAR:
REF: 68 LE 1

 0.51100 200.00000 A

-------------------------
 19  K  40
-------------------------
HALF LIFE:       1.28E+09A
GEN: NTH K  39
     NFA CA 40
     NAT 0.012
DAU:
PAR:
REF: 70 MA 3

 1.46075   10.70000 A

-------------------------
 19  K  42
-------------------------
HALF LIFE:          12.36H
GEN: NTH K  41
     NFA SC 45
     NFA CA 42
DAU:
PAR:
REF: 70 MA 3,71 ER 1

 0.31290    0.30000 A
 0.89960    0.06000 A
 1.02310    0.02000 A
 1.52470   17.90000 A
 1.92210    0.04000 A
 2.42415    0.02000 A

-------------------------
 19  K  43
-------------------------
HALF LIFE:          22.2H
GEN: NFA CA 43
     CHA AR 40
     PHO CA 44
DAU:
PAR:
REF: 73 EN 1

 0.22058    4.30000 A
 0.37281   88.30000 A
 0.39693   10.70000 A
 0.40428    0.40000 A
 0.59339   10.00000 A
 0.61751   78.70000 A
 0.80121    0.18000 A
 0.99032    0.25000 A
 1.02179    2.30000 A
 1.39460    0.11000 A

-------------------------
 19  K  44
-------------------------
HALF LIFE:          22.15M
GEN: NFA CA 44
DAU:
PAR:
REF: 73 IN 1

 0.26340    0.16730 A
 0.36830    3.09900 A
 0.40400    0.07307 A
 0.64670    0.21130 A
 0.65130    4.31400 A
 0.68220    0.82750 A
 0.72660    5.75700 A
 0.73290    0.25530 A
 0.74790    3.14300 A
 0.76140    0.09684 A
 0.87660    2.40300 A
 0.89070    0.14090 A
 1.02000    1.55800 A
 1.02470    9.50800 A
 1.05040    0.80990 A
 1.10780    0.84510 A
 1.12620   11.27000 A
 1.12930 PAIR PEAK
 1.15695   88.03000 A
 1.18990    0.04402 A
 1.21730    0.06803 A
 1.22230    0.49300 A
 1.24460    1.71700 A
 1.31480    0.07923 A
 1.49730 PAIR PEAK
 1.49910   11.71000 A
 1.50950    0.05282 A
 1.57530    0.14970 A
 1.58130    0.06162 A
 1.63420    0.26410 A
 1.64030 PAIR PEAK
 1.65830    0.18490 A
 1.70210    0.18490 A
 1.75210    6.03000 A
 1.77750    2.97600 A
 1.88020    0.13210 A
 1.88690    0.13210 A
 1.89510    0.13210 A
 2.00200    0.12320 A
 2.00830 PAIR PEAK
 2.14650    1.73400 A
 2.15130   34.69000 A
 2.50430    0.75710 A
 2.51930   11.88000 A
 2.61870    0.39620 A
 2.63420    0.36970 A
 2.63890 PAIR PEAK
 2.65220    0.19370 A
 2.65610    1.56700 A
 2.90940    0.02641 A
 2.98230    0.17610 A
 3.14990 PAIR PEAK
 3.20190    1.03000 A
 3.25280    0.25530 A
 3.30080    0.40500 A
 3.30410    0.33450 A
 3.39530    2.68500 A
```

Sumber : Erdtman, G.; Soyka, W., 1979, *The Gamma Ray Of The Radionuclides : Tables For Applied Gamma Ray Spectrometry*, Wienhein, New York : Verlag Chemie.

81 TL 199

HALF LIFE: 7.4H
GEN: CHA HG199
CHA AU197
DAU:
PAR:
REF: 68 LE 1,71 LE 1

0.03683			
0.04982	0.40000	A	
0.05190			
0.06889	26.00000	A	X
0.07082	47.00000	A	X
0.08020	17.00000	A	X
0.08250	4.70000	A	X
0.15837	5.40000	A	
0.19510	0.90000	A	
0.20818	11.90000	A	
0.24720	9.30000	A	
0.28400	1.30000	A	
0.33190	1.60000	A	
0.40350	0.40000	A	
0.45510	13.60000	A	
0.49200	1.00000	A	

81 TL 200

HALF LIFE: 1.088D
GEN: CHA TL203
CHA AU197
CHA HG
DAU:
PAR:
REF: 71 KO 1

0.06889	23.00000	A	X
0.07082	43.00000	A	X
0.08020	15.00000	A	X
0.08250	4.30000	A	X
0.11651	0.11500	A	
0.18217	0.05300	A	
0.25201	0.37100	A	
0.27200	0.03500	A	
0.28935	0.52100	A	
0.30918	0.26500	A	
0.34060	0.07100	A	
0.36797	88.40000	A	
0.38320	0.05300	A	
0.38730	0.16000	A	
0.39000	0.04400	A	
0.46400	0.02700	A	
0.46900	0.06200	A	
0.47682	0.32700	A	
0.48030	0.08000	A	
0.49620	0.08000	A	
0.51100	0.69000	A	
0.52140	0.28300	A	
0.53300	0.04400	A	
0.54120	0.02700	A	
0.54450	0.06100	A	
0.55670	0.09700	A	
0.56510	0.03500	A	
0.57928	14.00000	A	
0.59165	0.29200	A	
0.61208	0.24700	A	
0.62863	1.01600	A	
0.66135	2.31000	A	
0.68905	0.11500	A	
0.69430	0.03500	A	
0.70156	1.31000	A	
0.71175	0.27400	A	
0.71860	0.04400	A	
0.72060	0.04400	A	
0.78360	0.57000	A	
0.78710	1.04000	A	
0.82832	11.00000	A	
0.87330	0.07100	A	
0.88615	2.05000	A	
0.89852	0.63000	A	
0.93610	0.06200	A	
0.97530	0.07950	A	
1.02711	0.06200	A	
1.14712	0.12400	A	
1.16710	0.10600	A	
1.18050	0.11500	A	
1.20570	30.40000	A	
1.22550	3.40000	A	
1.25411	0.95000	A	
1.26297	0.80000	A	
1.27352	3.36000	A	
1.29111	0.61000	A	
1.35035	0.15000	A	
1.36290	3.45000	A	
1.36630	0.88000	A	
1.40764	1.47000	A	
1.47778	0.15000	A	
1.51490	4.06000	A	
1.57060	0.27000	A	
1.57360	0.05300	A	
1.60450	1.18000	A	
1.63120	0.08200	A	
1.69335	0.08000	A	
1.71835	0.33600	A	
1.74640	0.05700	A	
1.75915	0.18500	A	
1.78340	0.01400	A	
1.86100	0.00800	A	
1.87056	0.03100	A	
1.90630	0.11600	A	
1.92060	0.06500	A	
1.92870	0.00620	A	
1.96370	0.01600	A	
1.97530	0.04600	A	
2.00200	0.04300	A	
2.02060	0.02900	A	
2.22900	0.00350	A	
2.27400	0.01700	A	
2.28880	0.00350	A	
2.29640	0.03360	A	

81 TL 201

HALF LIFE: 3.063D
GEN: CHA PB204
CHA HG
DAU:
PAR:
REF: 71 AU 4,76 MA 1

0.01000	49.00000	A	X
0.03060	0.28000	A	
0.03219	0.32000	A	
0.06889	28.90000	A	X
0.07082	49.00000	A	X
0.08020	16.90000	A	X
0.08250	4.80000	A	X
0.13534	3.70000	A	
0.16588	0.19000	A	
0.16743	11.90000	A	

81 TL 202

HALF LIFE: 12.2D
GEN: NFA TL203
CHA HG201
DAU:
PAR:
REF: 69 GU 1,69 AD 1

0.06889	23.00000	A	X
0.07082	42.00000	A	X
0.08020	15.00000	A	X
0.08250	4.00000	A	X
0.43958	95.00000	A	
0.50960	0.07000	A	
0.52025	0.10000	A	
0.96000	0.07000	A	

81 TL 204

HALF LIFE: 3.78A
GEN: NTH TL203
NFA TL205
NFA PB204
DAU:
PAR:
REF: 70 MA 3

0.00999	0.76000	A	X
0.06889	0.40000	A	X
0.07082	0.74000	A	X
0.08020	0.26000	A	X
0.08250	0.07000	A	X

81 TL 206

HALF LIFE: 4.0M
GEN: NTH TL205
NFA PB206
NFA BI209
DAU:
PAR:
REF: 72 SE 2

0.80330	0.00650	A	

81 TL 207

HALF LIFE: 4.77M
GEN: NFA PB207
NFA BI209
NAT U 235
DAU:
PAR:
REF: 71 SC 1

0.89760	0.27000	A	

81 TL 207M

HALF LIFE: 1.3S
GEN: NFA PB207
CHA PB208
DAU: TL207
PAR:
REF: 68 LE 1

0.07083	4.00000	A	X
0.07287	8.00000	A	X
0.08250	2.70000	A	X
0.08490	0.80000	A	X
0.35000	80.00000	A	
1.00000	100.00000	A	

81 TL 208

HALF LIFE: 3.1M
GEN: NFA PB208
NAT TH232
DAU:
PAR:
REF: 69 PA 2,71 SC 1

0.07280	2.00000	A	X
0.07497	3.50000	A	X
0.08480	1.20000	A	X
0.08730	0.35000	A	X
0.21150	0.17000	A	
0.23350	0.30000	A	
0.25260	0.70000	A	
0.27730	6.50000	A	
0.30600	0.10000	A<	
0.48600	0.05000	A	
0.51072	22.50000	A	
0.58314	86.00000	A	
0.62500	0.03000	A<	
0.72230	0.27000	A	
0.76330	1.70000	A	
0.82110	0.10000	A	
0.86047	12.00000	A	
0.92770	0.13000	A	
0.98280	0.20000	A	
1.00400	0.01000	A	
1.09390	0.38000	A	
1.28270	0.05000	A	
1.38400	0.02000	A	
1.59247	PAIR PEAK		
1.64300	0.01000	A	
2.10347	PAIR PEAK		

Sumber : Erdtman, G.; Soyka, W., 1979, *The Gamma Ray Of The Radionuclides : Tables For Applied Gamma Ray Spectrometry,* Wienhein, New York : Verlag Chemie

LAMPIRAN C

(TABEL NILAI F DAN NILAI q UNTUK $\alpha = 0,05$)

Tabel Nilai F. 05†

Derajat kebebasan untuk pembilang

	1	2	3	4	5	6	7	8	9	10	12	15	20	24	30	40	60	120	∞
1	161	200	216	225	230	234	237	239	241	242	244	246	248	249	250	251	252	253	254
2	18.5	19.0	19.2	19.2	19.3	19.3	19.4	19.4	19.4	19.4	19.4	19.4	19.4	19.5	19.5	19.5	19.5	19.5	19.5
3	10.1	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81	8.79	8.74	8.70	8.66	8.64	8.62	8.59	8.57	8.55	8.53
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00	5.96	5.91	5.86	5.80	5.77	5.75	5.72	5.69	5.66	5.63
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77	4.74	4.68	4.62	4.56	4.53	4.50	4.46	4.43	4.40	4.37
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10	4.06	4.00	3.94	3.87	3.84	3.81	3.77	3.74	3.70	3.67
7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68	3.64	3.57	3.51	3.44	3.41	3.38	3.34	3.30	3.27	3.23
8	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39	3.35	3.28	3.22	3.15	3.12	3.08	3.04	3.01	2.97	2.93
9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18	3.14	3.07	3.01	2.94	2.90	2.86	2.83	2.79	2.75	2.71
10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02	2.98	2.91	2.85	2.77	2.74	2.70	2.66	2.62	2.58	2.54
11	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90	2.85	2.79	2.72	2.65	2.61	2.57	2.53	2.49	2.45	2.40
12	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80	2.75	2.69	2.62	2.54	2.51	2.47	2.43	2.38	2.34	2.30
13	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71	2.67	2.60	2.53	2.46	2.42	2.38	2.34	2.30	2.25	2.21
14	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.65	2.60	2.53	2.46	2.39	2.35	2.31	2.27	2.22	2.18	2.13
15	4.54	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.59	2.54	2.48	2.40	2.33	2.29	2.25	2.20	2.16	2.11	2.07
16	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54	2.49	2.42	2.35	2.28	2.24	2.19	2.15	2.11	2.06	2.01
17	4.45	3.59	3.20	2.96	2.81	2.70	2.61	2.55	2.49	2.45	2.38	2.31	2.23	2.19	2.15	2.10	2.06	2.01	1.96
18	4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.51	2.46	2.41	2.34	2.27	2.19	2.15	2.11	2.06	2.02	1.97	1.92
19	4.38	3.52	3.13	2.90	2.74	2.63	2.54	2.48	2.42	2.38	2.31	2.23	2.16	2.11	2.07	2.03	1.98	1.93	1.88
20	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45	2.39	2.35	2.28	2.20	2.12	2.08	2.04	1.99	1.95	1.90	1.84
21	4.32	3.47	3.07	2.84	2.68	2.57	2.49	2.42	2.37	2.32	2.25	2.18	2.10	2.05	2.01	1.96	1.92	1.87	1.81
22	4.30	3.44	3.05	2.82	2.66	2.55	2.46	2.40	2.34	2.30	2.23	2.15	2.07	2.03	1.98	1.94	1.89	1.84	1.78
23	4.28	3.42	3.03	2.80	2.64	2.53	2.44	2.37	2.32	2.27	2.20	2.13	2.05	2.01	1.96	1.91	1.86	1.81	1.76
24	4.26	3.40	3.01	2.78	2.62	2.51	2.42	2.36	2.30	2.25	2.18	2.11	2.03	1.98	1.94	1.89	1.84	1.79	1.73
25	4.24	3.39	2.99	2.76	2.60	2.49	2.40	2.34	2.28	2.24	2.16	2.09	2.01	1.96	1.92	1.87	1.82	1.77	1.71
30	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21	2.16	2.09	2.01	1.93	1.89	1.84	1.79	1.74	1.68	1.62
40	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18	2.12	2.08	2.00	1.92	1.84	1.79	1.74	1.69	1.64	1.58	1.51
60	4.00	3.15	2.76	2.53	2.37	2.25	2.17	2.10	2.04	1.99	1.92	1.84	1.75	1.70	1.65	1.59	1.53	1.47	1.39
120	3.92	3.07	2.68	2.45	2.29	2.18	2.09	2.02	1.96	1.91	1.83	1.75	1.66	1.61	1.55	1.50	1.43	1.35	1.25
∞	3.84	3.00	2.60	2.37	2.21	2.10	2.01	1.94	1.88	1.83	1.75	1.67	1.57	1.52	1.46	1.39	1.32	1.22	1.00

†Tabel ini dikutip dari M. Merrington aud C.M. Thompson, "Tables of percentage points of the inverted beta (F) distribution," *Biometrika*, Vol. 33 (1943).

Sumber : Supranto, J., 1995, *Statistik Teori dan Aplikasi*, Edisi kelima, Erlangga, Jakarta

TABLE B.5 (cont.) CRITICAL VALUES OF THE q DISTRIBUTION

$\alpha = 0.05$

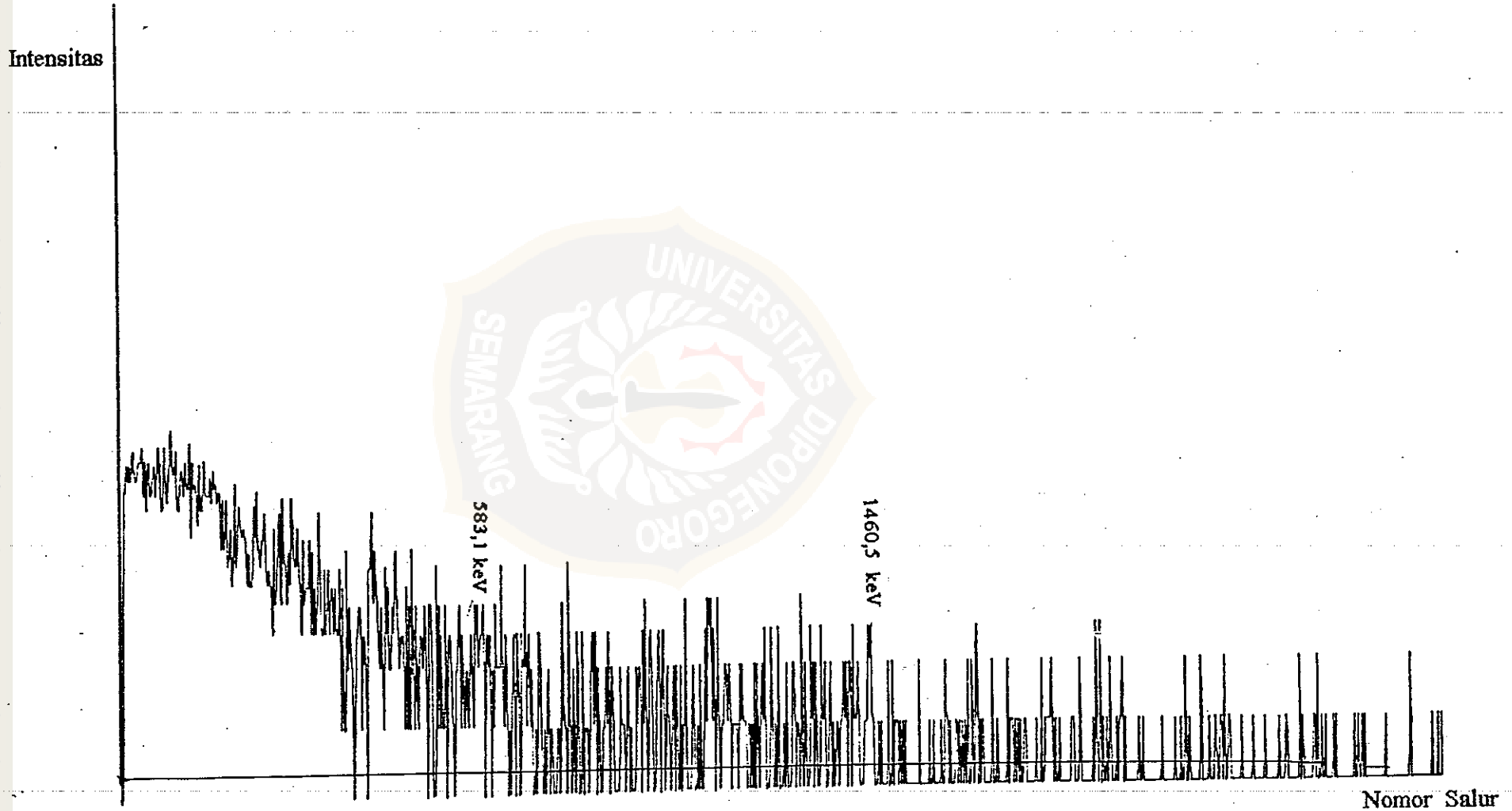
ν	k(or p) = 2	3	4	5	6	7	8	9	10
1	17.97	26.98	32.82	37.08	40.41	43.12	45.40	47.36	49.07
2	6.085	8.331	9.798	10.88	11.74	12.44	13.03	13.54	13.99
3	4.501	5.910	6.825	7.502	8.037	8.478	8.853	9.177	9.462
4	3.927	5.040	5.757	6.287	6.707	7.053	7.347	7.602	7.826
5	3.635	4.602	5.218	5.673	6.033	6.330	6.582	6.802	6.995
6	3.461	4.339	4.896	5.305	5.628	5.895	6.122	6.319	6.493
7	3.344	4.165	4.681	5.060	5.359	5.606	5.815	5.998	6.158
8	3.261	4.041	4.529	4.886	5.167	5.399	5.597	5.767	5.918
9	3.199	3.949	4.415	4.756	5.024	5.244	5.432	5.595	5.739
10	3.151	3.877	4.327	4.654	4.912	5.124	5.305	5.461	5.599
11	3.113	3.820	4.256	4.574	4.823	5.028	5.202	5.353	5.487
12	3.082	3.773	4.199	4.508	4.751	4.950	5.119	5.265	5.395
13	3.055	3.735	4.151	4.453	4.690	4.885	5.049	5.192	5.318
14	3.033	3.702	4.111	4.407	4.639	4.829	4.990	5.131	5.254
15	3.014	3.674	4.076	4.367	4.595	4.782	4.940	5.077	5.198
16	2.998	3.649	4.046	4.333	4.557	4.741	4.897	5.031	5.150
17	2.984	3.628	4.020	4.303	4.524	4.705	4.858	4.991	5.108
18	2.971	3.609	3.997	4.277	4.495	4.673	4.824	4.956	5.071
19	2.960	3.593	3.977	4.253	4.469	4.645	4.794	4.924	5.038
20	2.950	3.578	3.958	4.232	4.445	4.620	4.768	4.896	5.008
24	2.919	3.532	3.901	4.166	4.373	4.541	4.684	4.807	4.915
30	2.888	3.486	3.845	4.102	4.302	4.464	4.602	4.720	4.824
40	2.858	3.442	3.791	4.039	4.232	4.389	4.521	4.635	4.735
60	2.829	3.399	3.737	3.977	4.163	4.314	4.441	4.550	4.646
120	2.800	3.356	3.685	3.917	4.096	4.241	4.363	4.468	4.560
∞	2.772	3.314	3.633	3.858	4.030	4.170	4.286	4.387	4.474

ν	k(or p) = 11	12	13	14	15	16	17	18	19
1	50.59	51.96	53.20	54.33	55.36	56.32	57.22	58.04	58.83
2	14.39	14.75	15.08	15.38	15.65	15.91	16.14	16.37	16.57
3	9.717	9.946	10.15	10.35	10.53	10.69	10.84	10.98	11.11
4	8.027	8.208	8.373	8.525	8.664	8.794	8.914	9.028	9.134
5	7.168	7.324	7.466	7.596	7.717	7.828	7.932	8.030	8.122
6	6.649	6.789	6.917	7.034	7.143	7.244	7.338	7.426	7.508
7	6.302	6.431	6.550	6.658	6.759	6.852	6.939	7.020	7.097
8	6.054	6.175	6.287	6.389	6.483	6.571	6.653	6.729	6.802
9	5.867	5.983	6.089	6.186	6.276	6.359	6.437	6.510	6.579
10	5.722	5.833	5.935	6.028	6.114	6.194	6.269	6.339	6.405
11	5.605	5.713	5.811	5.901	5.984	6.062	6.134	6.202	6.265
12	5.511	5.615	5.710	5.798	5.878	5.953	6.023	6.089	6.151
13	5.431	5.533	5.625	5.711	5.789	5.862	5.931	5.995	6.055
14	5.364	5.463	5.554	5.637	5.714	5.786	5.852	5.915	5.974
15	5.306	5.404	5.493	5.574	5.649	5.720	5.785	5.846	5.904
16	5.256	5.352	5.439	5.520	5.593	5.662	5.727	5.786	5.843
17	5.212	5.307	5.392	5.471	5.544	5.612	5.675	5.734	5.790
18	5.174	5.267	5.352	5.429	5.501	5.568	5.630	5.688	5.743
19	5.140	5.231	5.315	5.391	5.462	5.528	5.589	5.647	5.701
20	5.108	5.199	5.282	5.357	5.427	5.493	5.553	5.610	5.663
24	5.012	5.099	5.179	5.251	5.319	5.381	5.439	5.494	5.545
30	4.917	5.001	5.077	5.147	5.211	5.271	5.327	5.379	5.429
40	4.824	4.904	4.977	5.044	5.106	5.163	5.216	5.266	5.313
60	4.732	4.808	4.878	4.942	5.001	5.056	5.107	5.154	5.199
120	4.641	4.714	4.781	4.842	4.898	4.950	4.998	5.044	5.086
∞	4.552	4.622	4.685	4.743	4.796	4.845	4.891	4.934	4.974

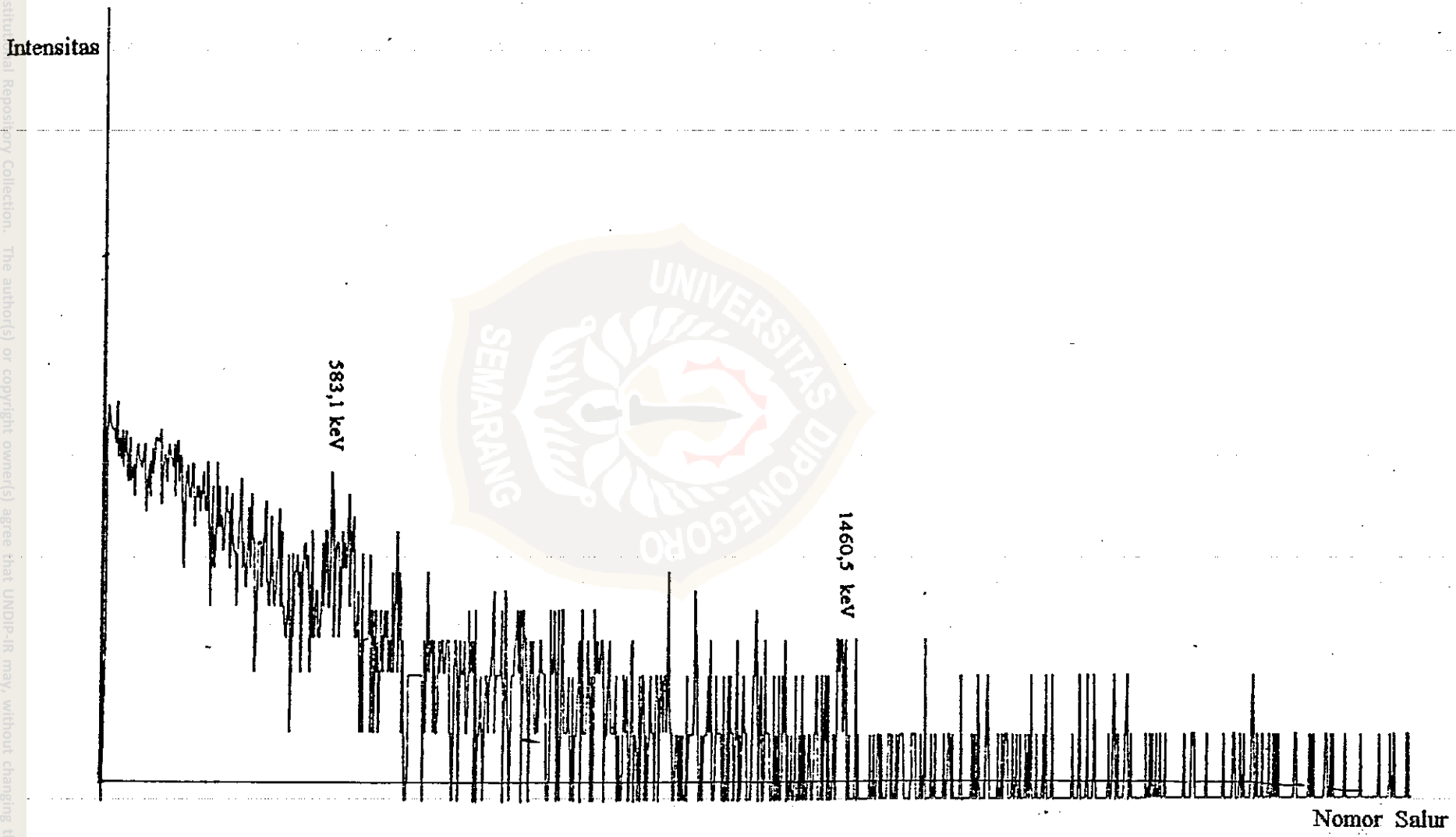
Sumber : Zar, Jerrold H., 1984, *Biostatistical Analysis*, 2nd ed., Prentice Hall, Inc., Englewood Cliffs, New Jersey.

LAMPIRAN D

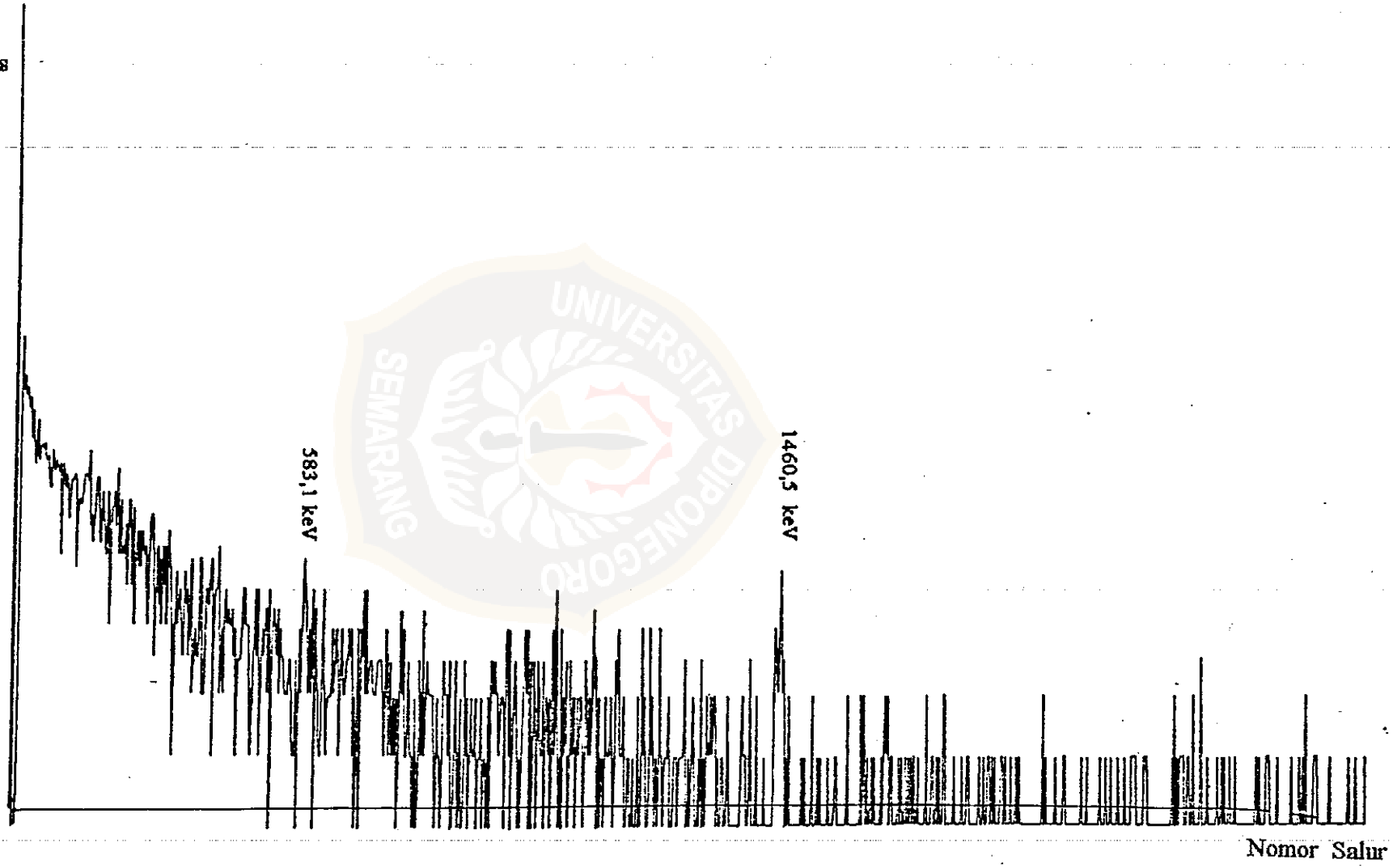
(SPEKTRUM GAMMA)



D.1. Spektrum gamma untuk cacah latar (Back ground)



D.2. Spektrum gamma untuk cuplikan kerang



Gb.D.3. Spektrum gamma untuk cuplikan air laut