^{106}Rh – Comments on evaluation of decay data by A. Arinc

Evaluation completed: March 2013
Literature cut-off date: December 2012

Evaluation procedure

Weighted mean analyses were applied to determine recommended values throughout the evaluation when the data were in statistical agreement. When the data were not in statistical agreement, the Limitation of Relative Statistical Weights (LRSW) was used. Uncertainties were expanded to match the minimum input uncertainty where appropriate.

Decay scheme

^{106}Rh is the daughter of ^{106}Ru and disintegrates by beta minus emission to various excited levels and the ground state of ^{106}Pd. The spins, parities, multipolarities, mixing ratios and level energies of ^{106}Pd are based on the mass-chain evaluation of De Frenne and Negret (2008De09).

The Q(β^-) value of 3546 (5) keV is taken from the evaluation of Wang *et al.* (2012Wa38).

Half-life

The experimental half-life values used for calculating the recommended value are given in Table 1. The half-life values from 1946Se30 and 1950Gl05 were omitted from the analysis as no uncertainty was given.

The data set is discrepant with a reduced-χ^2 of 10.9 on the Weighted Mean (WM) which is larger than the critical reduced-χ^2 of 6.63. The recommended value of 30.1 (3) seconds is the Unweighted Mean (UWM) of 1966Mi10 and 1969KoZW.

Table 1. Experimental half-life values of ^{106}Rh.

Reference	Half-life (seconds)	Comments
1946Se30	40	no uncertainty
1950Gl05	30	no uncertainty
1966Mi10	30.36 (15)	
1969KoZW	29.80 (8)	
UWM	30.1 (3)	
WM	29.92 (23)	reduced-χ^2 = 10.9
Recommended value	**30.1 (3)**	

In the majority of circumstances ^{106}Rh will be encountered in equilibrium with ^{106}Ru therefore an accurate knowledge of the half-life is not required; however for applications where the ^{106}Rh is unsupported by ^{106}Ru (for example decay heats), new measurements of the half-life would be beneficial as the available data are inconsistent and in excess of 40 years old.

Gamma rays

When more than one publication was available per laboratory only the latest published data were used (e.g. 1972Ma71 and 1973Ma35; 1960Ro12 and 1965Ro09). Published data with no reported uncertainty were not used for averaging process (i.e. 1971Az02, 1957Fi50).

Energies

The recommended values were derived from the differences in level energies as adopted from the mass-chain evaluation of 2008De09, and were compared to the experimental values calculated from the weighted mean (calculated with LWEIGHT4 code) of 1982Ka10, 1977Ok02, 1969St03, 1973Ma35, 1975Hs02, 1965Ro09, 1967Fo09, 1967Vr05 and 1968Ha35. When there was a disagreement between the calculated and evaluated gamma-ray emission energies, the latter were used. Although a few recent publications were available (1976Sh25, 1983Ku03 and 1993Ch32) on the precise measurement of the 511.85 keV gamma-ray emission energy, the recommended value of 511.8534 (23) keV was taken from Helmer and van der Leun (2000He14). The data set from Rao and Fink (1967Ra11) was not taken into account as many of the values in this publication were excluded by Chauvenet's criterion as outliers. In the publication of Forest *et al.* (1967Fo09) only the values up to 2614 keV were used as this was the last energy calibration point available to the user based upon the information given, and any energies above this point will have been based upon extrapolation. In the publication of Hsue *et al.* (1975Hs02), only the use of a standard gamma calibration source was mentioned, which usually does not cover gamma-ray emissions as high as 3.3 MeV. The values from 1975Hs02 above 2000 keV are generally lower and with smaller associated uncertainties compared with the rest of the values reported by other authors, which may imply that an extrapolation of the energies was performed rather than a more precise interpolation. Therefore, the evaluator has decided to increase the uncertainties of 1975Hs02 above 2000 keV to a minimum of 0.3 keV to be in line with other reported uncertainties.

Adopted nuclear levels of ^{106}Pd can be seen in Table 2.
The experimental results and recommended values can be seen in Table 1 of Appendix 1.

Table 2. Adopted nuclear levels of ^{106}Pd.

Nuclear level number	**Nuclear level energy (keV)**	**Spin and parity**
0	0	0 +
1	511.8547 (23)[a]	2 +
2	1128.02 (3)	2 +
3	1133.76 (4)	0 +
4	1229.30 (4)	4 +
5	1557.68 (4)	3 +
6	1562.25 (3)	2 +
7	1706.44 (5)	0 +
8	1909.37 (16)	(1 +, 2 +)
9	2001.48 (5)	0 +
10	2242.48 (5)	2 +
11	2278.11 (9)	0 +
12	2308.82 (5)	2 +
13	2439.10 (7)	2 +
14	2484.66 (20)	(1 -)
15	2500.31 (8)	2 -
16	2624.40 (5)	0 +
17	2705.30 (8)	(1 +)
18	2717.59 (21)	
19	2783.74 (21)	2 +
20	2820.97 (9)	2 +
21	2828.29 (9)	0 +
22	2877.92 (7)	0 +
23	2902.48 (10)	2 +
24	2917.86 (8)	2 +
25	2968.68 (21)	3 -
26	3037.32 (17)	1, 2
27	3054.97 (9)	1 +
28	3083.91 (18)	0
29	3163.7 (3)	(1, 2+)
30	3221.37 (25)	0 +
31	3249.9 (5)	2 +
32	3252.0 (4)	2 +
33	3273.5 (7)	1, 2
34	3299.2 (7)	
35	3320.5 (3)	0 +
36	3376.6 (9)	
37	3401.9 (6)	

[a)] Derived from Helmer and van der Leun (2000He14) gamma-ray emission energy of 511.8534 (23) keV.

Probabilities

The gamma-ray emission probabilities were calculated as weighted means (calculated with LWEIGHT4 code) of the measurements of 1982Ka10, 1977Ok02, 1975Hs02, 1975De17, 1973Ma35, 1969Od01, 1696St03, 1968Ha35, 1967Vr05, 1967Ra11, 1967Fo09, 1966Ov01, 1962Am03, 1960Se07 and 1960Ro12. In some of the earlier papers (1960Ro12, 1960Se07, 1962Am03 and 1966Ov01) the high energy gamma-ray emission probabilities were impossible to place due to large differences between the energies measured by the authors and the adopted energies. In the publication of Hsue *et al.* (1975Hs02), the reported annihilation contribution of

5.1 % on the most intense peak at 511.85 keV was disputed by Kaur *et al.* (1982Ka10) as being almost negligible. The annihilation contribution is dependent on the specifications of the gamma-ray spectrometry system and cannot be verified without precise details on the equipment and shielding used. Therefore the evaluator has decided to increase the reported uncertainties of 1975Hs02 by 5.1 %.
Values were initially normalised to an intensity for the 511.85 keV gamma-ray emission of 1000.

The experimental results and recommended values can be seen in Table 2 of Appendix 1.

<u>Internal conversion coefficients and E0 transition probability</u>

Theoretical internal conversion coefficients (ICCs) were calculated using the BrIcc code (Kibédi *et al.*, 2008Ki07) with the "frozen orbital" approximation, which uses interpolated values of Band *et al.* (2002Ba85).

The transition at 1133.75 keV is pure E0 and absolute measurements for this transition were not available; the transition probability cannot be calculated using the balance of the decay scheme because the beta probabilities are not well known for the levels concerned. Using the ratio of the K-conversion electron intensity of the E0 transition to that of the E2 transition at 621.9 keV, q^2_K(E0/E2) = 0.162 (7) from Kibédi and Spear (2005Ki02) and the following data for the 621.9 keV line:
Relative gamma-ray emission probability (Pγ): 481 (5)
ICC for K shell (α_K): 0.002 82 (40)

The calculated relative K-conversion intensity for the 1133.7 keV gamma ray is:
= $P\gamma_{(621)} \times \alpha_{K\ (621)} \times q^2_K$(E0/E2 of 1133 to 621)
= 481 (5) × 0.00282 (40) × 0.162 (7) = 0.22 (3)

Using the electronic factors for E0 calculated by BrIcc and assuming proportionality between the electronic factors and the conversion on each subshell, this gives a total relative conversion intensity for the 1133.7 keV transition of 0.25 (3).

<u>Normalisation factor</u>

Five absolute experimental values reported for the strongest gamma ray line at 511.85 keV are given in Table 3.

The AveTools computer code was used to calculate the average using three statistical methods: Limitation of Relative Statistical Weights (LRSW), Normalised Residual Methods (NRM) and the Rajeval Technique (RT).

Table 3. Absolute experimental values for the gamma ray line at 511.85 keV.

Reference	Absolute $P\gamma_{1,0}$ (%)	Used	Comments
1953Ka47	20.5	no	No uncertainty
1966Ov01	21.0 (20)	no	Later publication 1975Ge06 available
1969Od01	20.6 (6)	yes	
1975De17	20.47 (23)	yes	
1975Ge06	22.0 (11)	yes	Uncertainty quoted @ 95 % confidence
UWM	21.0 (5)		
WM	20.7 (4)		
LRSW	20. 9 (5)		
NRM	20.63 (21)		
RT	20.52 (21)		
Recommended value	**20.52 (23)**		Minimum input uncertainty used

The recommended value was taken from the Rajeval Technique and the minimum input uncertainty from 1975De17 was used. Using the absolute $P\gamma_{1,0}$ value calculated above we can derive a normalisation factor of 0.020 52 (23).

The theoretical value obtained from the balance of the decay scheme to the ground state, taking the beta emission efficiency $\beta_{0,0}$ from 1992Gr21 of 79.1 (16) %, is 0.0202 (16) which is in good agreement with the value calculated from the experimental data.

Beta particles

Energies

The values of the maximum beta-particle energies were derived from the $Q(\beta^-)$ = 3546 (5) keV value from Wang *et al.* (2012Wa38) and the adopted nuclear level energies given in Table 2. The experimental data for the maximum beta-particle emission energies to the ground state ($\beta_{0,0\ max}$) is in good agreement with the calculated data and can be found in Table 4.

The mean beta-particle energies and log *ft* values were calculated with the LOGFT code.

Table 4. Experimental values for the maximum beta-particle emission energies to the ground state and first excited state of ^{106}Pd.

Reference	$\beta_{0,0\ max}$ (MeV)	$\beta_{0,1\ max}$ (MeV)
1947Pe07	3.55 (10)	
1958Gr07	3.55 (1)	
1966JoZZ	3.55 (100)	3.04 (7)
1963Ke13	3.55	3.07
1969Be74	3.52 (12)	
Recommended value	**3.546 (5)**	**3.034 (5)**

<u>Emission probabilities</u>
The theoretical beta-particle probabilities were calculated from the P(γ+ce) balance using the GTOL software and are given in Table 5.

Table 5. Beta-particle emission energies, probabilities, transition type and log *ft* values of ^{106}Rh.

Transition	$E_{\beta max}$ (keV)	P_β (%)	Transition type	log ft
$\beta_{0,0}$	3546 (5)	78.80 (24)	Allowed	5.18
$\beta_{0,1}$	3034 (5)	8.2 (3)	Allowed	5.87
$\beta_{0,2}$	2418 (5)	0.608 (21)	Allowed	6.58
$\beta_{0,3}$	2412 (5)	9.82 (15)	Allowed	5.37
$\beta_{0,4}$	2317 (5)	0.005 1 (5)	Unique 2nd Forbidden	11.0
$\beta_{0,6}$	1984 (5)	1.67 (3)	Allowed	5.79
$\beta_{0,7}$	1840 (5)	0.066 4 (10)	Allowed	7.06
$\beta_{0,8}$	1637 (5)	0.002 77 (21)	(Allowed)	8.24
$\beta_{0,9}$	1545 (5)	0.448 (9)	Allowed	5.93
$\beta_{0,10}$	1304 (5)	0.037 2 (8)	Allowed	6.72
$\beta_{0,11}$	1268 (5)	0.043 (5)	Allowed	6.62
$\beta_{0,12}$	1237 (5)	0.043 0 (7)	Allowed	6.57
$\beta_{0,13}$	1107 (5)	0.020 8 (5)	Allowed	6.71
$\beta_{0,14}$	1061 (5)	0.000 93 (15)	(1st Forbidden)	7.99
$\beta_{0,15}$	1046 (5)	0.028 4 (6)	1st Forbidden	6.48
$\beta_{0,16}$	922 (5)	0.090 (3)	Allowed	5.78
$\beta_{0,17}$	841 (5)	0.010 6 (4)	(Allowed)	6.56
$\beta_{0,18}$	828 (5)	0.000 23 (12)	-	-
$\beta_{0,19}$	762 (5)	0.001 17 (8)	Allowed	7.36
$\beta_{0,20}$	725 (5)	0.009 0 (3)	Allowed	6.40
$\beta_{0,21}$	718 (5)	0.007 31 (19)	Allowed	6.47
$\beta_{0,22}$	668 (5)	0.026 2 (9)	Allowed	5.81
$\beta_{0,23}$	644 (5)	0.007 60 (18)	Allowed	6.29
$\beta_{0,24}$	628 (5)	0.018 3 (7)	Allowed	5.87
$\beta_{0,25}$	577 (5)	0.000 22 (4)	Unique 1st Forbidden	7.82
$\beta_{0,26}$	509 (5)	0.002 2 (3)	-	-
$\beta_{0,27}$	491 (5)	0.010 1 (5)	Allowed	5.76
$\beta_{0,28}$	462 (5)	0.002 78 (13)	-	-
$\beta_{0,29}$	382 (5)	0.000 70 (5)	(Allowed)	6.55
$\beta_{0,30}$	325 (5)	0.004 02 (13)	Allowed	5.56
$\beta_{0,31}$	296 (5)	0.000 086 (16)	Allowed	7.09
$\beta_{0,32}$	294 (5)	0.000 21 (4)	Allowed	6.70
$\beta_{0,33}$	272 (5)	0.000 049 (14)	-	-
$\beta_{0,34}$	247 (5)	0.000 082 (21)	-	-
$\beta_{0,35}$	226 (5)	0.000 87 (8)	Allowed	5.71
$\beta_{0,36}$	169 (5)	0.000 025 (9)	-	-
$\beta_{0,37}$	144 (5)	0.000 012 5 (19)	-	-

Table 6. Published values for the beta-particle emission probability to the ground state of ^{106}Pd.

Reference	$\beta_{0,0}$ (%)
1947Pe07	82 (2)
1958Gr07	90
1960Se07	70
1962Am03	67.2
1963Ke13	63
1966JoZZ	90
1992Gr21	79.1 (16)
Recommended value	**78.80 (24)**

The most recent and most precise measurement of the beta-particle emission probability to the ground state of ^{106}Pd reported by Greenwood *et al.* (1992Gr21) using total absorption gamma-ray spectrometry (TAGS) and the value derived theoretically from the singles gamma studies agree within the stated uncertainties.

Atomic data

The values of ω_K, ϖ_L, n_{KL} and relative probabilities of the X-ray and Auger emissions were derived from Schönfeld and Janßen (1996Sc06).

The energies and relative emission probabilities of the X-ray and Auger electrons have been calculated using the computer code EMISSION. A summary of the results is given in Tables 7 and 8. There are no known publications of measured data with which these values can be compared.

Table 7. Calculated L X-ray emission energies and probabilities.

L Xray	Energy, /keV	Calculated value
Ll	2.50	0.000 174 (5)
Lα	2.83 – 2.84	0.004 68 (11)
Lη	2.66	0.000 060 8 (17)
Lβ	2.99 – 3.17	0.002 70 (8)
Lγ	3.25 – 3.55	0.000 242 (6)
LX total		0.007 85 (14)

Table 8. Calculated K X-ray emission energies and probabilities.

K Xray	Energy, /keV	Calculated value
$K\alpha_2$	21.02	0.031 0 (5)
$K\alpha_1$	21.18	0.058 6 (9)
$K\beta_1'$	23.8 – 24.0	0.016 08 (29)
$K\beta_2'$	24.30 – 24.34	0.002 73 (10)
KX total		0.108 5 (17)

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Appendix 1: Experimental and recommended gamma-ray emission energies and probabilities.

Table 1. Experimental and recommended gamma-ray emission energies (keV).

	1982Ka10	1977Ok02	1975Hs02[a]	1973Ma35	1969St03	1968Ha35	1967Fo09[b]	1967Ra11[c]	1967Vr05	1965Ro09	**Evaluated**	**Recommended**
$\gamma_{6,3}$	428.40 (20)	428.4 (2)	428.39 (22)	428.3 (3)	427.9 (5)	427.7 (10)	-	-	-	-	**428.35 (20)**	**428.49 (5)**
$\gamma_{6,2}$	434.25 (21)	434.2 (3)	434.3 (5)	434.1 (5)	435.0 (15)	-	-	-	-	-	**434.23 (21)**	**434.23 (4)**
$\gamma_{9,6}$	439.17 (27)	439.5 (5)	-	439.6 (10)	-	-	-	-	-	-	**439.3 (3)**	**439.23 (6)**
$\gamma_{1,0}$	511.83 (8)	511.85 (10)	511.80 (15)	511.8 (8)	511.8 (2)	511.9 (3)	512.0 (5)	511.6 (5)	511.8 (2)	511.6 (5)	**-**	**511.8534 (23)**[d]
$\gamma_{7,2}$	578.3 (2)	578.4 (2)	578.2 (9)	578.3 (3)	578.0 (4)	578.0 (15)	-	-	-	-	**578.31 (20)**	**578.42 (6)**
$\gamma_{2,1}$	616.22 (9)	616.2 (3)	616.33 (17)	616.1 (2)	616.2 (3)	616.0 (6)	616.0 (7)	616.6 (5)	-	616.2 (9)	**616.22 (9)**	**616.16 (3)**
$\gamma_{3,1}$	621.93 (6)	621.84 (10)	622.2 (3)	621.7 (2)	621.8 (3)	622.0 (3)	622.4 (5)	622.8 (5)	622.0 (2)	622.2 (5)	**621.91 (6)**	**621.90 (4)**
$\gamma_{10,6}$	680.25 (14)	680.2 (2)	680.6 (4)	680.1 (3)	680.1 (6)	-	-	-	-	-	**680.21 (14)**	**680.23 (6)**
$\gamma_{10,5}$	684.8 (2)	684.7 (2)	684.8 (8)	684.7 (4)	684.3 (8)	-	-	-	-	-	**684.75 (20)**	**684.80 (6)**
$\gamma_{17,9}$	702.8 (10)	-	-	-	-	-	-	-	-	-	**702.8 (10)**	**702.8 (10)**
$\gamma_{11,6}$	715.9 (2)	715.9 (2)	715.7 (5)	715.8 (3)	716.2 (3)	-	-	-	-	-	**715.92 (20)**	**715.86 (9)**
$\gamma_{4,1}$	717.4 (2)	717.3 (2)	717.3 (5)	717.3 (5)	717.1 (3)	716.6 (10)	-	717.6 (5)	-	-	**717.34 (20)**	**717.44 (4)**
$\gamma_{12,5}$	751.3 (2)	751.1 (6)	751.7 (8)	751.4 (10)	749.6 (15)	749 (2)	-	-	-	-	**751.26 (20)**	**751.26 (20)**
$\gamma_{9,2}$	873.49 (5)	873.5 (1)	873.73 (9)	873.1 (2)	873.1 (3)	873.7 (4)	873.5 (6)	873.4 (5)	-	873.5 (7)	**873.52 (5)**	**873.46 (6)**
$\gamma_{15,5}$	942.6 (4)	939.6 (20)	-	942.7 (10)	-	940 (3)	-	-	-	-	**942.5 (4)**	**942.63 (9)**
$\gamma_{5,1}$	1045.6 (6)	1045.8	1044.8 (15)	1046.5	1045.7	-	-	-	-	-	**1045.5 (6)**	**1045.82 (4)**
$\gamma_{6,1}$	1050.41 (6)	1050.4 (1)	1050.47 (7)	1050.3 (3)	1050.1 (3)	1050.3 (4)	1050.1 (6)	1049.8 (5)	-	1049.8 (7)	**1050.42 (6)**	**1050.39 (3)**
$\gamma_{16,6}$	1062.14 (5)	1062.2 (1)	1062.22 (8)	1062.0 (3)	1062.1 (5)	1062.7 (10)	1061.5 (8)	1061.8 (7)	-	-	**1062.16 (5)**	**1062.14 (6)**
$\gamma_{10,3}$	1108.7 (1)	1108.7 (5)	1108.66 (19)	1108.5 (3)	1108.9 (3)	-	-	-	-	-	**1108.69 (10)**	**1108.71 (6)**
$\gamma_{10,2}$	1114.48 (5)	1114.5 (3)	1114.69 (10)	1114.4 (3)	1114.6 (3)	1114 (2)	-	1114.0 (9)	-	-	**1114.52 (5)**	**1114.45 (6)**

	1982Ka10	1977Ok02	1975Hs02[a]	1973Ma35	1969St03	1968Ha35	1967Fo09[b]	1967Ra11[c]	1967Vr05	1965Ro09	**Evaluated**	**Recommended**
$\gamma_{2,0}$	1128.07 (5)	1128.1 (2)	1128.21 (6)	1128.0 (2)	1128.0 (3)	1128.0 (4)	1127.8 (6)	1127.8 (5)	-	1127.4 (7)	**1128.07 (5)**	**1128.01 (3)**
$\gamma_{3,0}$	-	-	-	-	-	-	-	-	-	-	**-**	**1133.75 (4)**
$\gamma_{11,2}$	1150.2 (2)	1150.2 (2)	1150.21 (24)	1150.4 (5)	1150.1 (15)	1148 (2)	-	-	-	-	**1150.20 (20)**	**1150.08 (9)**
$\gamma_{18,5}$	1159.9 (2)	-	-	-	1159.7 (20)	-	-	-	-	-	**1159.80 (20)**	**1159.90 (21)**
$\gamma_{12,2}$	1180.73 (8)	1180.8 (2)	1180.86 (9)	1180.5 (3)	1180.6 (3)	1180 (2)	-	1179.8 (5)	-	-	**1180.77 (8)**	**1180.79 (6)**
$\gamma_{7,1}$	1194.54 (5)	1194.6 (1)	1194.68 (6)	1194.4 (3)	1194.3 (3)	1194.5 (6)	1194.2 (8)	1192.6 (5)	-	-	**1194.59 (5)**	**1194.58 (5)**
$\gamma_{13,4}$	1209.8 (2)	1209.7 (3)	1210.2 (7)	1209.7 (10)	-	-	-	-	-	-	**1209.79 (20)**	**1209.79 (8)**
$\gamma_{20,6}$	1258.8 (2)	1258.8 (3)	-	1258.3 (10)	1257.0 (20)	-	-	-	-	-	**1258.77 (20)**	**1258.71 (9)**
$\gamma_{21,6}$	1266.0 (2)	1266.1 (3)	1266.4 (7)	1266.0 (5)	1266.6 (15)	-	-	-	-	-	**1266.05 (20)**	**1266.03 (9)**
$\gamma_{13,3}$	1305.2 (2)	1305.3 (3)	1305.2 (8)	1305.3 (5)	1305.6 (10)	-	-	-	-	-	**1305.24 (20)**	**1305.33 (8)**
$\gamma_{22,6}$	1315.7 (2)	1315.7 (3)	1315.43 (24)	1315.7 (5)	1316.8 (15)	1315.4 (10)	-	-	-	-	**1315.61 (20)**	**1315.66 (8)**
$\gamma_{24,6}$	1355.7 (3)	1356.0 (3)	-	1355.5 (5)	1355.0 (6)	-	-	-	-	-	**1355.7 (3)**	**1355.60 (9)**
$\gamma_{24,5}$	1360.2 (3)	1360.1 (3)	1360.4 (4)	1360.1 (3)	1359.9 (6)	-	-	-	-	-	**1360.2 (3)**	**1360.17 (9)**
$\gamma_{15,2}$	1372.3 (3)	1372.3 (3)	1371.7 (3)	1372.0 (4)	-	1372 (4)	-	-	-	-	**1372.1 (3)**	**1372.28 (9)**
$\gamma_{8,1}$	1397.6 (2)	1397.7 (3)	1397.66 (15)	1397.1 (3)	1397.3 (4)	1396 (2)	-	-	-	-	**1397.56 (15)**	**1397.51 (16)**
$\gamma_{9,1}$	1489.6 (6)	1489.7 (6)	1489.46 (18)	1489.1 (5)	1488.9 (6)	1489.5 (15)	-	-	-	-	**1489.42 (18)**	**1489.61 (5)**
$\gamma_{16,2}$	1496.33 (13)	1496.6 (2)	1496.22 (8)	1496.1 (3)	1496.4 (3)	1497.5 (6)	1498.0 (12)	1495.5 (5)	1497 (1)	-	**1496.30 (8)**	**1496.37 (6)**
$\gamma_{27,5}$	1498.8 (2)	-	1498.71 (16)	1498.2 (8)	-	-	-	-	-	-	**1498.73 (16)**	**1498.73 (16)**
$\gamma_{6,0}$	1562.25 (6)	1562.2 (1)	1562.20 (6)	1561.9 (2)	1562.0 (3)	1562.4 (6)	1562.0 (10)	1561.6 (5)	-	1562.5 (11)	**1562.21 (6)**	**1562.24 (3)**
$\gamma_{17,3}$	1572.4 (2)	1572.3 (6)	1572.7 (3)	1572.4 (5)	1574.4 (9)	-	-	-	-	-	**1572.47 (20)**	**1572.47 (20)**

	1982Ka10	1977Ok02	1975Hs02[a]	1973Ma35	1969St03	1968Ha35	1967Fo09[b]	1967Ra11[c]	1967Vr05	Evaluated	Recommended
$\gamma_{17,2}$	1577.2 (2)	1576.9 (8)	1577.1 (5)	1577.0 (7)	1579.8 (10)	-	-	-	-	**1577.16 (20)**	**1577.27 (9)**
$\gamma_{20,3}$	1687.4 (3)	1687.6 (10)	-	1687.9 (10)	1686.1 (20)	-	-	-	-	**1687.4 (3)**	**1687.20 (10)**
$\gamma_{20,2}$	1693.2 (3)	1693.0 (4)	-	1693.5 (8)	-	1695 (3)	~1694.5	-	-	**1693.2 (3)**	**1693.2 (3)**
$\gamma_{10,1}$	1730.5 (2)	1730.5 (3)	1730.6 (3)	1730.1 (3)	1730.0 (15)	-	~1730.8	-	-	**1730.44 (20)**	**1730.44 (20)**
$\gamma_{11,1}$	1766.25 (5)	1766.2 (2)	1766.25 (7)	1766.0 (2)	1766.2 (3)	1766.4 (15)	1767.7 (20)	1765.3 (5)	1765 (1)	**1766.24 (5)**	**1766.24 (9)**
$\gamma_{23,2}$	1774.5 (3)	1774.4 (7)	1774.2 (8)	1773.9 (5)	1775.0 (15)	-	-	-	-	**1774.4 (3)**	**1774.44 (10)**
$\gamma_{24,3}$	1784.1 (3)	1783.8 (7)	-	1784.5 (10)	1784.0 (20)	-	-	-	-	**1784.1 (3)**	**1784.08 (9)**
$\gamma_{12,1}$	1796.94 (9)	1796.9 (1)	1796.77 (7)	1796.6 (2)	1796.7 (3)	1797.0 (15)	1798.1 (20)	1795.7 (5)	1796 (1)	**1796.83 (7)**	**1796.95 (5)**
$\gamma_{28,4}$	1855.0 (2)	-	1854.8 (10)	1854.4 (5)	1854.8 (4)	-	-	-	-	**1854.89 (20)**	**1854.89 (20)**
$\gamma_{26,2}$	1909.3 (2)	1909.4 (2)	1909.3 (5)	1909.5 (5)	1909.4 (8)	-	~1909.2	-	-	**1909.36 (20)**	**1909.28 (17)**
$\gamma_{13,1}$	1927.22 (9)	1927.3 (2)	1926.96 (8)	1927.0 (3)	1927.2 (3)	1927.0 (15)	1927.8 (15)	1925.3 (5)	-	**1927.09 (8)**	**1927.23 (7)**
$\gamma_{28,2}$	1954.6 (4)	1954.9 (8)	-	1955.9 (10)	1956.9 (20)	-	-	-	-	**1954.9 (4)**	**1954.9 (4)**
$\gamma_{14,1}$	1973.5 (10)	1973.3 (8)	-	-	-	-	-	-	-	**1973.4 (8)**	**1973.4 (8)**
$\gamma_{15,1}$	1988.44 (8)	1988.6 (1)	1988.09 (7)	1988.1 (3)	1988.5 (3)	1989.0 (15)	1989.1 (15)	1986.3 (5)	-	**1988.32 (23)**	**1988.44 (8)**
$\gamma_{30,2}$	2093.3 (4)	2093.0 (4)	2092.5 (12)	2092.8 (10)	2094.1 (15)	-	-	-	-	**2093.1 (4)**	**2093.33 (25)**
$\gamma_{16,1}$	2112.54 (6)	2112.6 (2)	2112.1 (3)[a]	2112.4 (3)	2112.7 (2)	2113.6 (10)	2112.8 (20)	2111.0 (5)	-	**2112.54 (6)**	**2112.52 (5)**
$\gamma_{35,3}$	2185.7 (5)	-	-	-	-	-	-	-	-	**2185.7 (5)**	**2185.7 (5)**
$\gamma_{17,1}$	2193.2 (1)	2193.3 (2)	2192.7 (3)[a]	2193.0 (3)	2193.2 (6)	2194 (2)	2193.9 (22)	2189.3 (5)	-	**2193.17 (10)**	**2193.17 (10)**
$\gamma_{10,0}$	2242.4 (1)	2242.4 (2)	2242.0 (3)[a]	2242.4 (5)	2242.4 (8)	2243 (2)	2242.3 (20)	2241.4 (10)	-	**2242.40 (10)**	**2242.45 (5)**
$\gamma_{19,1}$	2271.9 (2)	2271.8 (3)	2271.5 (3)	2271.4 (5)	2271.7 (5)	2278 (3)	2271.9 (30)	-	-	**2271.75 (20)**	**2271.86 (21)**

	1982Ka10	1977Ok02	1975Hs02[a]	1973Ma35	1969St03	1968Ha35	1967Fo09[b]	1967Ra11[c]	**Evaluated**	**Recommended**
$\gamma_{20,1}$	2309.0 (1)	2309.3 (2)	2308.5 (3)[a]	2308.4 (8)	2308.7 (4)	2310 (2)	2309.9 (20)	2307.8 (9)	**2308.99 (10)**	**2309.09 (9)**
$\gamma_{21,1}$	2316.4 (1)	2316.5 (2)	2315.9 (3)[a]	2316.6 (3)	2317.6 (5)	2317 (2)	2316.3 (30)	2314.8 (9)	**2316.39 (10)**	**2316.41 (9)**
$\gamma_{22,1}$	2366.04 (7)	2366.1 (2)	2365.6 (3)[a]	2365.8 (3)	2366.4 (3)	2366.4 (15)	2366.5 (20)	2366.9 (5)	**2366.03 (7)**	**2366.04 (7)**
$\gamma_{23,1}$	2390.6 (1)	2390.6 (2)	2390.0 (3)[a]	2390.7 (3)	2390.8 (3)	2389 (3)	2391.4 (20)	2390.3 (5)	**2390.58 (10)**	**2390.60 (10)**
$\gamma_{24,1}$	2405.96 (9)	2406.0 (2)	2405.5 (3)[a]	2406.0 (3)	2406.0 (3)	2406 (2)	2406.5 (20)	2406.6 (5)	**2405.94 (9)**	**2405.98 (8)**
$\gamma_{13,0}$	2439.1 (1)	2439.1 (2)	2438.6 (3)[a]	2439.0 (3)	2438.5 (3)	2439 (3)	2440.8 (20)	2437.3 (5)	**2439.01 (10)**	**2439.07 (7)**
$\gamma_{25,1}$	2456.8 (2)	2455.9 (15)	-	2457.3 (10)	-	-	-	-	**2456.80 (20)**	**2456.79 (21)**
$\gamma_{14,0}$	2484.6 (2)	2484.8 (3)	2484.0 (3)	2484.6 (5)	2485.7 (10)	-	2486.0 (20)	-	**2484.54 (20)**	**2484.63 (20)**
$\gamma_{26,1}$	2525.2 (6)	2525.2 (10)	2525.4 (10)	2525.4 (10)	2525.2 (20)	-	-	-	**2525.3 (6)**	**2525.43 (17)**
$\gamma_{27,1}$	2542.7 (1)	2542.8 (3)	2542. 9 (3)[a]	2542.8 (3)	2543.4 (3)	2544 (2)	2544.3 (20)	2544.9 (6)	**2542.79 (10)**	**2542.79 (10)**
$\gamma_{28,1}$	2571.1 (2)	2571.2 (3)	2570.7 (3)	2571.2 (3)	2571.2 (3)	2573 (5)	2571.5 (30)	2571.4 (6)	**2571.16 (20)**	**2571.16 (20)**
$\gamma_{29,1}$	2651.4 (2)	2651.7 (3)	2651.0 (4)	2651.0 (5)	2651.6 (7)	2650 (5)	2653.1 (30)[b]	2650.4 (6)	**2651.39 (20)**	**2651.39 (20)**
$\gamma_{17,0}$	2705.1 (3)	2705.3 (3)	2705.1 (3)	2705.3 (5)	2706.6 (3)	-	-	-	**2705.2 (3)**	**2705.26 (8)**
$\gamma_{30,1}$	2709.5 (3)	2709.6 (3)	2708.7 (3)[a]	2709.2 (5)	2709.4 (3)	2708 (3)	2710.1 (15)[b]	2709.0 (5)	**2709.3 (3)**	**2709.48 (25)**
$\gamma_{32,1}$	2740.1 (4)	2740.5 (4)	-	2739.5 (10)	2740.5 (6)	-	-	-	**2740.3 (4)**	**2740.1 (4)**
$\gamma_{34,1}$	2787.3 (7)	2788.5 (5)	-	2788.5 (10)	-	-	-	-	**2788.2 (5)**	**2788.2 (5)**
$\gamma_{35,1}$	2809.0 (3)	2809.2 (3)	2808.4 (5)	2809.1 (5)	2809.5 (6)	-	2812.1 (18)[b]	2814.4 (8)	**2809.1 (3)**	**2809.1 (3)**
$\gamma_{20,0}$	2821.1 (3)	2821.3 (3)	2820.3 (3)	2821.0 (5)	2821.2 (4)	2825 (5)	2823.0 (18)[b]	2826.6 (8)	**2821.2 (3)**	**2821.2 (3)**
$\gamma_{36,1}$	-	2865.0 (10)	-	-	-	-	-	-	**2865.0 (10)**	**2865.0 (10)**
$\gamma_{23,0}$	2902.5 (8)	2902.7 (5)	-	2901.8 (10)	2904.1 (15)	-	~2898.7[b]	-	**2902.6 (5)**	**2902.6 (5)**

	1982Ka10	1977Ok02	1975Hs02[a]	1973Ma35	1969St03	1968Ha35	1967Fo09[b]	1967Ra11[c]	**Evaluated**	**Recommended**
$\gamma_{24,0}$	2917.9 (3)	2918.0 (3)	2917.1 (3)	2917.3 (5)	2917.9 (8)	2920 (5)	2919.7 (18)[b]	2918.0 (8)	**2917.6 (3)**	**2917.6 (3)**
$\gamma_{26,0}$	3037.4 (3)	3037.3 (3)	3036.5 (3)	3036.6 (5)	3036.8 (6)	3038 (2)	3039.7 (20)[b]	3042.0 (8)	**3037.0 (3)**	**3037.3 (3)**
$\gamma_{27,0}$	3055.0 (4)	3054.9 (3)	3053.5 (9)	3055.1 (5)	3055.6 (10)	-	3057.2 (30)[b]	3058.0 (10)	**3055.0 (3)**	**3055.0 (3)**
$\gamma_{29,0}$	3164.7 (10)	3165.4 (13)	-	3165.3 (25)	3161.5 (20)	-	-	-	**3164.6 (10)**	**3164.6 (10)**
$\gamma_{31,0}$	3249.8 (5)	3249.8 (5)	-	3251.8 (15)	-	-	~3252[b]	-	**3249.9 (5)**	**3249.8 (5)**
$\gamma_{33,0}$	3273.4 (7)	3273.3 (5)	-	3275.5 (15)	-	-	-	-	**3273.5 (5)**	**3273.4 (7)**
$\gamma_{36,0}$	-	3375.9 (14)	-	-	-	-	-	-	**3375.9 (14)**	**3375.9 (14)**
$\gamma_{37,0}$	-	3401.8 (9)	-	-	-	-	-	-	**3401.8 (9)**	**3401.8 (9)**

a) For data above 2000 keV, the uncertainty was increased to a minimum of 0.3 keV.
b) Only data up to the last energy calibration point of 2614 keV were taken into account in evaluation.
c) Data set not used as majority of values were rejected as outliers by Chauvenet's criterion.
d) Data taken from Helmer and van der Leun (2000He14).

Table 2. Experimental and recommended relative gamma-ray emission probabilities.

E_γ (keV)	1982Ka10	1977Ok02	1975Hs02[a]	1975De17	1973Ma35	1969St03	1969Od01	1968Ha35	1967Vr05	1967Ra11	1967Fo09	1966Ov01	1962Am03	1960Ro12	1960Se07	**Recommended**
428.49 (5)	3.46 (11)	3.6 (4)	3.12 (24)	-	3.48 (20)	4.5 (5)	-	1.4 (5)	-	-	-	-	-	-	-	**3.43 (11)**
434.23 (4)	0.99 (10)	0.9 (2)	1.18 (8)	-	0.77 (8)	2.3 (6)	-	-	-	-	-	-	-	-	-	**0.97 (21)**
439.23 (6)	0.62 (10)	0.46 (20)	-	-	0.50 (8)[b]	-	-	-	-	-	-	-	-	-	-	**0.54 (8)**
511.8534 (23)	1000	1000	1000 (65)	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000 (50)	1000 (40)	1000	**1000**
578.42 (6)	0.41 (4)	0.46 (3)	0.4 (3)	-	0.46 (4)	0.41 (4)	-	0.64 (2)	-	-	-	-	-	-	-	**0.44 (3)**
616.16 (3)	37.2 (33)	35.9 (72)	43 (6)	35.9 (7)	38 (2)	33.7 (27)	32 (2)	35 (7)	34 (4)	35 (3)	50 (10)	-	-	49 (13)	-	**35.6 (7)**
621.90 (4)	486.8 (60)	474 (24)	515 (38)	487 (6)	476 (23)	476 (15)	477 (5)	480 (10)	485 (10)	485 (10)	473 (6)	530	440 (50)	470 (30)	530 (20)	**481 (5)**
680.23 (6)	0.54 (3)	0.45 (6)	0.44 (8)	-	0.54 (5)	0.36 (6)	-	-	-	-	-	-	-	-	-	**0.50 (3)**
684.80 (6)	0.27 (1)	0.24 (4)	0.31 (22)	-	0.28 (3)	0.12 (3)	-	-	-	-	-	-	-	-	-	**0.269 (10)**
702.8 (10)	0.014 (9)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**0.014 (9)**
715.86 (9)	0.49 (2)	0.48 (8)	0.34 (15)	-	0.46 (6)	0.75 (7)[c]	0.69 (20)[c]	0.80 (10)[c]	-	<0.9[c]	-	-	-	-	-	**0.484 (20)**
717.44 (4)	0.32 (2)	0.33 (7)	0.34 (15)	-	0.39 (6)				-		-	-	-	-	-	**0.327 (20)**
751.26 (20)	0.053 (11)	0.044 (15)	0.06 (4)	-	0.12 (4)	0.09 (9)	-	0.12 (3)	-	-	-	-	-	-	-	**0.059 (11)**
873.46 (6)	21.5 (3)	20.9 (13)	23.7 (17)	20.9 (4)	25.0 (12)	20.2 (8)	23 (1)	19.0 (12)	20 (1)	21 (1)	18.0 (25)	-	17.1 (20)	18 (2)	35 (5)	**21.2 (3)**
942.63 (9)	0.028 (7)	0.026 (10)[d]	-	-	~0.05	-	-	0.12 (4)	-	-	-	-	-	-	-	**0.029 (9)**
1045.82 (4)	0.65 (8)	-	0.59 (18)	-	-	-	-	-	-	-	-	-	-	-	-	**0.64 (8)**
1050.39 (3)	76.4 (15)	72.7 (44)	84 (6)	71.1 (9)	73.5 (40)	70.6 (28)	73.5 (30)	72 (4)	80 (5)	75 (4)	63 (10)	-	-	68 (4)	90 (10)	**72.6 (9)**
1062.14 (6)	1.57 (2)	1.43 (4)	1.67 (14)	-	1.45 (10)	1.20 (9)	1.7 (6)	1.2 (2)	1.1 (2)	1.3 (1)	2.0 (3)	-	-	-	-	**1.48 (9)**
1108.71 (6)	0.29 (1)	0.24 (7)	0.26 (4)	-	0.22 (2)	0.25 (3)	-	-	-	-	-	-	-	-	-	**0.273 (14)**
1114.45 (6)	0.58 (1)	0.51 (9)	0.55 (5)	-	0.56 (5)	0.40 (6)	0.62 (25)	0.45 (10)	0.64	1.2 (4)	-	-	-	-	-	**0.572 (13)**

E_γ (keV)	1982Ka10	1977Ok02	1975Hs02[a]	1975De17	1973Ma35	1969St03	1969Od01	1968Ha35	1967Vr05	1967Ra11	1967Fo09	1966Ov01	1960Ro12	**Recommended**
1128.01 (3)	19.8 (3)	19.2 (4)	22.0 (16)	18.6 (4)	19.3 (9)	18.7 (8)	21.5 (10)	19 (2)	20.6	20 (1)	16.0 (25)	-	24 (3)	**19.4 (3)**
1133.75 (4)[e]	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
1150.08 (9)	0.15 (1)	0.132 (8)	0.17 (3)	-	0.14 (2)	<0.02	-	0.32 (10)	-	-	-	-	-	**0.140 (8)**
1159.90 (21)	0.008 (6)	-	-	-	-	0.02 (1)	-	-	-	-	-	-	-	**0.011 (6)**
1180.79 (6)	0.71 (1)	0.68 (4)	0.76 (6)	-	0.69 (4)	0.68 (7)	1.1 (3)	0.60 (5)	0.83	0.9 (1)	-	-	-	**0.704 (10)**
1194.58 (5)	2.81 (2)	2.64 (10)	3.11 (23)	-	2.60 (13)	2.56 (13)	2.7 (2)	2.6 (2)	2.9	2.8 (2)	2.3 (3)	-	-	**2.791 (24)**
1209.79 (8)	0.022 (5)	0.015 (4)	0.027 (14)	-	0.020 (4)	-	-	-	-	-	-	-	-	**0.019 (4)**
1258.71 (9)	0.028 (4)	0.036 (7)	-	-	0.038 (8)	0.048 (24)	-	-	-	-	-	-	-	**0.032 (4)**
1266.03 (9)	0.051 (5)	0.058 (8)	0.06 (3)	-	0.052 (10)	0.033 (16)	-	-	-	-	-	-	-	**0.053 (5)**
1305.33 (8)	0.065 (7)	0.051 (6)	0.040 (23)	-	0.043 (8)	0.14 (6)	-	-	-	-	-	-	-	**0.053 (6)**
1315.66 (8)	0.17 (1)	0.162 (12)	0.16 (3)	-	0.11 (1)	0.18 (6)	0.25 (10)	0.13 (10)	-	-	0.20 (6)	-	-	**0.147 (23)**
1355.60 (9)	0.031 (7)	0.017 (6)	-	-	0.058 (10)	0.031 (15)	-	-	-	-	-	-	-	**0.029 (12)**
1360.17 (9)	0.109 (6)	0.077 (6)	0.095 (24)	-	0.14 (2)	0.058 (10)	-	-	-	-	-	-	-	**0.090 (19)**
1372.28 (9)	0.101 (9)	0.091 (7)	0.137 (22)	-	0.10 (2)	-	-	0.27 (10)	-	-	-	-	-	**0.097 (7)**
1397.51 (16)	0.13 (1)	0.122 (10)	0.169 (23)	-	0.17 (2)	0.15 (2)	-	0.27 (10)	-	-	-	-	-	**0.135 (10)**
1489.61 (5)	0.06 (3)	0.087 (14)	0.090 (13)	-	0.19 (4)	0.08 (2)	-	0.2 (1)	0.15	-	-	-	-	**0.090 (13)**
1496.37 (6)	1.09 (3)	1.30 (8)	1.19 (9)	-	1.11 (8)	1.25 (6)	1.6 (1)	1.5 (5)	1.4	1.50 (15)	0.99 (10)	-	-	**1.17 (8)**
1498.73 (16)	0.33 (2)	-	0.37 (4)	-	0.25 (6)	-	-	-	-	-	-	-	-	**0.331 (20)**
1562.24 (3)	8.0 (1)	7.66 (38)	8.9 (7)	7.26 (10)	7.4 (4)	7.1 (3)	7.8 (4)	8.6 (10)	8	8.1 (5)	7.2 (8)	8.1 (3)	6.3 (5)	**7.6 (4)**
1572.47 (20)	0.09 (1)	0.083 (9)	0.086 (23)	-	0.13 (2)	-	-	-	-	-	-	-	-	**0.090 (9)**

E_γ (keV)	1982Ka10	1977Ok02	1975Hs02[a]	1973Ma35	1969St03	1969Od01	1968Ha35	1967Vr05	1967Ra11	1967Fo09	1966Ov01	1960Ro12	1960Se07	**Recommended**
1577.27 (9)	0.052 (9)	0.042 (8)	0.056 (24)	0.06 (1)	0.08 (3)	-	-	-	-	-	-	-	-	**0.051 (8)**
1687.20 (10)	0.027 (6)	0.010 (8)	-	0.05 (1)	0.05 (2)	-	-	-	-	-	-	-	-	**0.027 (8)**
1693.2 (3)	0.032 (6)	0.035 (10)	-	0.058 (17)	-	0.10 (5)	0.06 (3)	-	-	0.084 (17)	-	-	-	**0.040 (7)**
1730.44 (20)	0.109 (6)	0.090 (9)	0.100 (17)	0.12 (1)	0.07 (2)	0.10 (5)	-	-	-	0.077 (15)	-	-	-	**0.102 (6)**
1766.24 (9)	1.68 (3)	1.34 (12)	1.62 (13)	1.20 (6)	1.13 (6)	1.3 (1)	1.4 (2)	1.5	1.3 (1)	1.1 (2)	2.6 (6)	1.9 (3)	2.0 (7)	**1.46 (22)**
1774.44 (10)	0.062 (11)	0.045 (4)	0.042 (22)	0.060 (18)	0.030 (15)	-	-	-	-	-	-	-	-	**0.046 (4)**
1784.08 (9)	0.021 (6)	0.0055 (15)	-	0.02 (1)	0.025 (15)[f]	-	-	-	-	-	-	-	-	**0.021 (6)[g]**
1796.95 (5)	1.36 (2)	1.22 (7)	1.48 (11)	1.27 (6)	1.23 (7)	1.35 (10)	1.1 (2)	1.4	1.3 (1)	0.99 (20)	-	-	-	**1.334 (22)**
1854.89 (20)	0.061 (4)	-	0.043 (23)	0.12 (3)	0.04 (2)	-	-	-	-	-	-	-	-	**0.061 (5)**
1909.28 (17)	0.070 (5)	0.060 (5)	0.068 (22)	0.040 (4)	0.033 (8)	-	-	-	-	<0.058	-	-	-	**0.052 (12)**
1927.23 (7)	0.75 (2)	0.66 (4)	0.80 (6)	0.71 (11)	0.64 (5)	0.63 (6)	0.70 (15)	0.65	0.64 (6)	0.74 (8)	-	-	-	**0.716 (20)**
1954.9 (4)	0.011 (6)	0.009 (2)	-	0.015 (5)	-	-	-	-	-	-	-	-	-	**0.009 9 (20)**
1973.4 (8)	0.009 (5)	0.008 (2)	-	-	-	-	-	-	-	-	-	-	-	**0.008 1 (20)**
1988.44 (8)	1.28 (2)	1.18 (7)	1.41 (11)	1.23 (6)	1.07 (7)	1.0 (2)	1.3 (2)	1.2	1.2 (1)	1.25 (20)	1.4 (6)	1.0 (2)	-	**1.255 (21)**
2093.33 (25)	0.018 (4)	0.013 (3)	0.022 (16)	0.012 (3)	0.03 (3)	-	-	-	-	-	-	-	-	**0.014 (3)**
2112.52 (5)	1.71 (3)	1.69 (9)	1.95 (16)	1.75 (15)	1.56 (11)	1.7 (2)	1.7 (2)	1.6	1.7 (1)	1.8 (3)	1.5 (3)	1.3 (2)	3 (1)	**1.71 (3)**
2185.7 (5)	0.012 (3)	-	-	-	-	-	-	-	-	-	-	-	-	**0.012 (3)**
2193.17 (10)	0.24 (1)	0.229 (13)	0.26 (3)	0.25 (2)	0.27 (3)	0.5 (2)	0.24 (6)	0.4	0.23 (3)	0.26 (4)	-	-	-	**0.241 (10)**
2242.45 (5)	0.101 (3)	0.086 (6)	0.105 (12)	0.09 (1)	0.070 (15)	0.077 (10)	0.13 (2)	-	<0.3	0.083 (12)	-	-	-	**0.095 (4)**
2271.86 (21)	0.067 (4)	0.052 (4)	0.051 (11)	0.045 (5)	0.070 (14)	0.063 (10)	0.08 (3)	-	-	0.068 (10)	-	-	-	**0.057 (4)**

E_γ (keV)	1982Ka10	1977Ok02	1975Hs02[a]	1973Ma35	1969St03	1969Od01	1968Ha35	1967Vr05	1967Ra11	1967Fo09	1960Ro12	1960Se07	**Recommended**
2309.09 (9)	0.276 (7)	0.252 (13)	0.306 (26)	0.28 (2)	0.29 (2)	0.35 (5)	0.30 (6)	0.3	0.29 (4)	0. 30 (4)	-	-	**0.280 (7)**
2316.41 (9)	0.312 (7)	0.287 (15)	0.348 (27)	0.29 (3)	0.28 (2)	0.31 (5)	0.30 (6)	0.3	0.29 (4)	0.28 (3)	-	-	**0.303 (7)**
2366.04 (7)	1.14 (3)	1.08 (6)	1.25 (9)	1.12 (10)	1.04 (8)	1.1 (1)	1.4 (3)	0.95	1.1 (1)	1.35 (15)	1.7 (2)	-	**1.13 (3)**
2390.60 (10)	0.319 (7)	0.30 (2)	0.337 (27)	0.30 (3)	0.32 (3)	0.39 (4)	0.34 (8)	0.26	0.33 (4)	0.38 (4)	-	-	**0.321 (7)**
2405.98 (8)	0.71 (2)	0.68 (4)	0.81 (6)	0.60 (6)	0.60 (5)	0.78 (5)	0.72 (15)	0.58	0.70 (7)	0.85 (9)	-	-	**0.705 (20)**
2439.07 (7)	0.225 (6)	0.214 (11)	0.253 (25)	0.25 (2)	0.19 (2)	0.22 (5)	0.25 (8)	0.2	0.27 (3)	0.29 (3)	-	0.3 (1)	**0.226 (6)**
2456.79 (21)	0.014 (2)	0.010 (2)	-	0.006 (3)	-	-	-	-	-	-	-	-	**0.010 9 (21)**
2484.63 (20)	0.044 (3)	0.036 (4)	0.05 (1)	0.030 (3)	0.026 (6)	0.059 (15)	-	-	-	0.062 (15)	-	-	**0.037 (7)**
2525.43 (17)	0.010 (2)	0.0028 (14)	0.015 (8)	0.005 (2)	0.004 (4)	-	-	-	-	-	-	-	**0.005 2 (15)**
2542.79 (10)	0.145 (4)	0.139 (8)	0.158 (14)	0.14 (1)	0.12 (1)	0.10 (2)	0.15 (5)	0.14	0.12 (2)	0.17 (3)	-	-	**0.141 (4)**
2571.16 (20)	0.071 (3)	0.066 (4)	0.068 (12)	0.050 (5)	0.066 (7)	0.053 (10)	0.07 (3)	0.06	0.66 (15)	0.090 (13)	-	-	**0.065 (3)**
2651.39 (20)	0.034 (2)	0.032 (4)	0.030 (7)	0.030 (5)	0.033 (6)	-	~ 0.02	-	0.53 (8)	0.039 (15)	-	-	**0.033 0 (20)**
2705.26 (8)	0.123 (5)	0.125 (20)	0.137 (22)	0.10 (1)	0.15 (2)	-	0.31 (9)[h]	-	0.35 (4)[h]	0.39 (5)[h]	0.3 (1)[h]	0.3 (1)[h]	**0.121 (6)**
2709.48 (25)	0.183 (5)	0.185 (20)	0.211 (24)	0.18 (2)	0.17 (2)	0.19 (5)		0.2					**0.182 (5)**
2740.1 (4)	0.012 (2)	0.010 (2)	-	0.009 (2)	0.010 (3)	-	-	-	-	-	-	-	**0.010 3 (20)**
2788.2 (5)	0.0041 (20)	0.0039 (10)	-	0.004 (1)	-	-	-	-	-	-	-	-	**0.004 0 (10)**
2809.1 (3)	0.034 (2)	0.029 (2)	0.033 (8)	0.028 (3)	0.020 (4)	-	-	-	0.04 (1)	0.055 (16)	-	-	**0.030 1 (20)**
2821.2 (3)	0.059 (2)	0.057 (4)	0.074 (12)	0.060 (6)	0.051 (6)	0.12 (5)	0.05 (3)	0.045	0.07 (2)	0.070 (14)	-	-	**0.058 6 (20)**
2865.0 (10)	-	0.0007 (4)	-	-	-	-	-	-	-	-	-	-	**0.000 7 (4)**
2902.6 (5)	0.0032 (10)	0.0028 (10)	-	0.003 (1)	0.006 (2)	-	-	-	-	<0.0102	-	-	**0.003 2 (10)**

E_γ (keV)	1982Ka10	1977Ok02	1975Hs02[a]	1973Ma35	1969St03	1968Ha35	1967Vr05	1967Ra11	1967Fo09	**Recommended**
2917.6 (3)	0.045 (2)	0.046 (5)	0.046 (7)	0.050 (5)	0.048 (5)	0.05 (2)	0.06	0.06 (2)	0.067 (13)	**0.046 0 (20)**
3037.0 (3)	0.050 (2)	0.053 (6)	0.065 (9)	0.052 (6)	0.048 (5)	0.06 (2)	0.05	0.07 (2)	0.076 (11)	**0.051 4 (20)**
3055.0 (3)	0.017 (2)	0.014 (2)	0.019 (9)	0.025 (3)	0.014 (7)	-	-	0.023 (6)	0.023 (7)	**0.017 6 (20)**
3164.6 (10)	0.0014 (7)	0.00029 (13)	-	~ 0.001	0.002 (2)	-	-	-	-	**0.001 1 (6)**[g]
3249.8 (5)	0.0051 (13)	0.0039 (8)	-	0.004 (1)	-	-	-	-	<0.015	**0.004 2 (8)**
3273.4 (5)	0.0025 (11)	0.0020 (7)	-	0.003 (1)	-	-	-	-	-	**0.002 4 (7)**
3375.9 (14)	-	0.00055 (10)	-	-	-	-	-	-	-	**0.000 55 (10)**
3401.8 (9)	-	0.00061 (9)	-	-	-	-	-	-	-	**0.000 61 (9)**

a) Uncertainty of 5.1 % added in quadrature to published data.
b) Sum of 437.5 keV and 439.6 keV gamma-ray emission probabilities.
c) Sum of 715.86 keV and 717.44 keV gamma-ray emission probabilities.
d) Gamma ray only observed in coincidence spectra.
e) E0 transition, no gamma ray observed.
f) Sum of 1784.0 keV and 1789.0 keV gamma-ray emission probabilities.
g) Recommended data was calculated using Rajeval Technique as the two most precise data are not in agreement.
h) Sum of 2705.26 keV and 2709.48 keV gamma-ray emission probabilities.