^{214}Po - Comments on evaluation of decay data
by V. Chisté and M. M. Bé

This evaluation was completed in 2007. Literature available by January 2007 was included.

1 Decay Scheme

^{214}Po disintegrates by alpha emissions mainly to the ground state level of ^{210}Pb. Spins and parities are from the mass-chain evaluation of Y. A. Akovali (1995El07 for A = 214) and E. Browne (1992Br01 and 2003Br13 for A = 210).
A good agreement was found between the recommended Q value of Audi and the effective Q value (7833.24 (10) keV) calculated from decay scheme data.

2 Nuclear Data

The Q value is from the atomic mass evaluation of Audi *et al.* (2003Au03).
Experimental ^{214}Po half-life values (in μs) are given in Table 1:

Table 1: Experimental values of ^{214}Po half-life.

Reference	Experimental value (μs)	Comments
J. V. Dunworth (1939Du**)	150 (20)	Not used.
J. Rotblat (1941Ro**)	145 (5)	Not used.
A. G. Ward (1942Wa04)	148 (6)	Not used.
J. C. Jacobsen (1943Ja**)	155 (5)	Not used.
G. von Dardel (1950Vo02)	163.7 (18)	Original uncertainty increased
R. Ballini (1953Ba60)	158 (2)	
K. W. Ogilvie (1960Og01)	159.5 (30)	
T. Dobrowolski (1961Do02)	164.3 (18)	
A. Erlik (1971Er02)	165 (3)	
J. W. Zhou (1993Zh30)	160 (12)	
Recommended value	**162.3 (12)**	χ^2 = 1.6

The first four and less precise historical values were omitted from analysis. The G. von Dardel uncertainty value (1950Vo02) of 0.2, which seems not realistic, was increased to 1.8 the smallest of the other experimental values obtained with the same method.
Using the LWEIGHT computer program (version 3) with the remaining set of 6 data, the weighted average is **162.3** m**s** with an external uncertainty of **1.2** m**s**. The reduced-χ^2 value is 1.82.

The largest contribution to weighted average comes from the value of G. von Dardel (1950Vo02) and T. Dobrowolski (1961Do02), each of them amounting per 28 %.

2.1 a Transitions and Emissions

The energies of the α-particle transitions given in Section 2.1 were obtained from Q_α (2003Au03) and level energies.

The energy of $\alpha_{0,0}$ emission given in section 4 is the weighted average of the measured values of A. Rytz (1961Ry02) and B. Grennberg (1971Gr17), with the recommendations given by A. Rytz (1991Ry01) where the original energies given by 1961Ry02 and 1971Gr17 have been readjusted due to changes in calibration

energies. For the $\alpha_{0,1}$ and $\alpha_{0,2}$, the emission energies were deduced from Q_α (2003Au03), level energy and taking the nucleus recoil into account.

The α emission probabilities have been deduced from the value of the γ-ray transition probability decay-scheme balances for the corresponding levels. (see **2.2 Gamma Transitions**).

2.2 g Transitions

The γ-ray transition probabilities were obtained using the γ-ray emission intensities, measured by 1976Ku08, and the relevant internal conversion coefficients (see **4.2** g **Emissions**).
Multipolarities of the γ -ray transitions (E2) are from 1992Br01 and 2003Br13.

The internal conversion coefficients (ICC) for the γ -ray transitions have been deduced using the BrIcc computer program (calculation for 'hole'), which interpolated the new values from 2006Ra03.

3 Atomic Data

Atomic values, ω_K, ϖ_L and n_{KL} and the X-ray relative probabilities are from Schönfeld and Janβen (1996Sc06).

4 Photon Emissions

4.1 X-ray Emissions

The X-ray absolute intensities were calculated from γ-ray data and ICC using the EMISSION computer program.

4.2 g Emissions

The γ-ray energies given in section 5.2 are from W. Kurcewicz (1976Ku08).

The absolute γ-ray emission intensities have been deduced from the relative γ-ray emission intensities measured by W. Kurcewicz (1976Ku08) in relative value and normalized with the 324.22-keV γ-ray in ^{222}Ra decay, as measured by A. Peghaire (1969Pe17) to be 2.77 (8) %. In the table 2, the relative emission intensities and the recommended values of absolute emission intensities are shown.

Table 2: Recommended (deduced) values of γ-ray absolute emission intensities

Energy (keV)	Relative Emission Intensity (%)	Recommended value
298 (1)	0.06 (2)	0.000052 (18) %
799.7 (1)	11.9 (5)	0.0104 (6) %

5 References

1939Du** – J. V. Dunworth, Nature (London) 144(1939)152 [Half-life].
1941Ro** – J. Rotblat, Proc. Roy. Soc. (London) A177(1941)260 [Half-life].
1942Wa04 – A. G. Ward, Proc. Roy. Soc. (London) A181(1942)183 [Half-life].
1943Jo** – J. C. Jacobsen, T. Sigurgeirsson, Kgl. D. Vid. Selsk. Medd. 20(1943)11 [Half-life].
1950Vo02 – G. von Dardel, Phys. Rev. 79(1950)734 [Half-life].
1953Ba60 – R. Ballini, Ann. Phys. (Paris) 8(1953)441 [Half-life].
1960Og01 – K. W. Ogilvie, Proc. Phys. Soc. (London) 76(1960)299 [Half-life].

1961Do02 – T. Dobrowolski, J. Young, Proc. Phys. Soc. (London) 77(1961)1219 [Half-life].
1961Ry02 – A. Rytz, Helv. Phys. Acta 34(1961)240 [E_α].
1969Pe17 – A. Peghaire, Nucl. Instrum. Meth. 75(1969)66 [I_γ].
1971Er02 – A. Erlik, J. Felsteiner, H. Lindeman, M. Tatcher, Nucl. Instrum. Meth. 92(1971)45 [Half-life].
1971Gr17 – B. Grennberg, A. Rytz, Metrologia 7(1971)65 [E_α].
1976Ku08 – W. Kurcewicz, N. Kaffrell, N. Trautmann, A. Plochocki, J. Kylicz, K. Stryczniewicz, I. Yutlandov, Nucl. Phys. A270(1976)175 [I_γ, E_γ, I_α].
1991Ry01 – A. Rytz, At. Data and Nucl. Data Tables 47(1991)205 [E_α, I_α].
1992Br01 – E. Browne, Nucl. Data Sheets 65(1992)209 [Energy level, spin, parity and multipolarity].
1993Zh30 – J. W. Zhou, P. de Marcillac, N. Coron, S. Wang , H. H. Stroke, O. Redi, J. Leblanc, G. Dambier, M. Barthelemy, J. P. Torre, O. Testard, G. Beyer, H. Ravn, J. Mangin, Nucl. Instrum. Meth. Phys. Res. A335(1993)443 [Half-life].
1995El07 – Y. A. Akovali, Nucl. Data Sheets 76(1995)127 [I_α, E_α, I_γ, E_γ, spin and parity].
1996Sc06 – E. Schönfeld, H. Janβen, Nucl. Instrum. Meth. Phys. Res. A369(1996)527 [Atomic data].
1998Ak04 – Y. A. Akovali, Nucl. Data Sheets 84(1998)1 [I_α, E_α].
2002Ba85 – I. M. Band, M. B. Trzhaskovskaya, C. W. Nestor, Jr., P. O. Tikkanen, S. Raman, At. Data Nucl. Data Tables 81(2002)1 [Theoretical ICC].
2003Au03 – G. Audi, A. H. Wapstra, C. Thibault, Nucl. Phys. A729(2003)129 [Q].
2003Br13 – E. Browne, Nucl. Data Sheets 99(2003)483 [Energy level, spin, parity and multipolarity].
2006Ra03 – S.Raman, M.Ertugrul, C.W.Nestor, Jr., M.B.Trzhaskovskaya. At.Data Nucl.Data Tables 92, 207 (2006) *Ratios of internal conversion coefficients*