These remarks and comments are only for evaluators; they should not be printed in the LPRI-PTB “Table of Radionuclides”. References are given only in those cases where the reference is not already included in the list of references in Part I.

1 Decay Scheme

Below the $Q_{EC}$ value of 186 keV there is a 11/2- level of 144.8 keV in $^{125}$Te which is populated in the $^{125}$Sb disintegration but not in the $^{125}$I disintegration. A transition to this level would have $\Delta I = 3$ and parity change (non-unique 3rd forbidden). From the $lg ft$ systematics (Ramann, 1973) evaluator expects $lg ft > 15$ which corresponds to transition probability of $< 1 \times 10^{-8}$ per disintegration.

A direct transition from the ground state of $^{125}$I to the ground state of $^{125}$Te ($\Delta I = 2$, no parity change, non-unique 2nd forbidden) was also not observed. Smith and Lewis (1966) have found the transition probability of such a transition to be smaller than 0.01 and from $lg ft$ systematics (Ramann, 1973), the $lg ft > 11.0$ which corresponds to transition probability of $1 \times 10^{-6}$ per disintegration.

Assuming that there is no 144.8 keV level and no transition between the ground states, the decay scheme given on page 1 is complete.

The half-life of the 35.5 keV level has been determined by several authors:

1. 1,58(15) ns Graham et al. (1953)
2. 1,555(27) ns Voorthuis et al. (1967)
3. 1,475(10) ns Hohenemser and Rosner (1968)
4. 1,486(9) ns Berlovich et al. (1970)
5. 1,50(8) ns Bajaj et al. (1970)
6. 1,45(3) ns Marelius et al. (1970)
7. 1,407(35) ns Bond et al. (1971)
8. 1,51(5) ns Satyanarayana et al. (1972)
9. 1,482(9) ns weighted mean of 2 - 8 and adopted value

The largest weights are from value 3 (38 %) and 4 (47 %). The uncertainty of the weighted mean is the external because this is the larger one (internal: $\pm 0.006$ ns).

2 Nuclear Data

The following values of the half-life have been considered ($T_{1/2}$ in d):

1. 56  Reid and Keston (1946)
2. 60,0(5)  Friedlander and Orr (1951)
3. 60  Kusnezova et al. (1958)
4. 57,4(2)  Matthews (1960)
5. 60,25(6)  Leutz et al. (1964)
6. 59,83  Anspach et al. (1965)
7. 58,76(13)  Richmond and Findly (1966)
8. 59,89(6)  Lagoutine et al. (1968); originally $\pm 0.18$ d (3 $\sigma$)
9. 60,18(17)  Emery et al. (1972)
10. 59,666 (16)  Kündig and Müller (1979)
11. 59,156(20)  Houtermans et al. (1980)
Values 1 - 11 are only cited for reasons of completeness. The well agreeing values 12 - 19 indicate that the true value is very close to 59,4 d. Taking this into account, we can classify the older values 1 - 11 (when looking to the uncertainty given by the authors) into values which are too low (4 by 10 σ, 7 by 4 σ, 11 by 12 σ) or too high (5 by 14 σ, 8 by 10 σ, 9 by 5 σ, 10 by 17 σ). These values have a large spread. The evaluator consider it to be senseful to calculate an average of these values only after enlarging their uncertainties by reasonable (but more or less arbitrarily chosen) factors. Values 1, 3, 6 are excluded because no uncertainty is given. Value 2 is a good value but because of its large uncertainty it does not contribute very much to the average.

As there are enough new accurate values we do not include all these old values into the averaging procedure. The unweighted and weighted average of the values 13 - 19 are given as values 20 and 21. The adopted value 22 is the LWM where the relative weight of value 17 is reduced to 50 % and the uncertainty is expanded so as to include this value which is the most accurate one according to the uncertainty assigned to it by the authors. The reduced $\chi^2$ of this set of seven values is 0,66 indicating a very consistent set.

The $Q_{EC}$ value 185,77(6) keV is taken from Hindi et al. (1994). It was measured via the internal bremsstrahlung spectrum, recorded in a planar Ge detector. This value is in agreement with 186,1(3) keV obtained by Borge et al. (1986). It is substantially larger then the value of 178(2) keV also obtained as internal bremsstrahlung endpoint by Gopinathan and Rubinson (1968) and 179,3(20) obtained by Flower et al. (1990). Audi and Wapstra (1995) recommended also the value of 185,77 (6) keV.

### 2.1 Electron Capture Transitions

The adopted values $P_K$, $P_L$, $P_M$, $P_N$ were calculated from the table of Schönfeld (1995) using the adopted $Q_{EC}$ value. Ter Mateosian (1953) found $P_L/P_K = 0,23(3)$. Leutz and Ziegler (1964) found $(P_L + P_M + P_N)/P_K = 0,2547(33)$ and 0,2539(21) using two different extrapolation methods. The mean value 0,253(27) corresponds to $P_K = 0,797(3)$. Smith and Lewis (1966) found for the above ratio 0,253(5). Karttunen et al. (1969) measured $P_K/\alpha_K = 0,685(18)$ (2 σ) whereas Plch and Zderadicka (1974) found 0,685(12) and Tolea et al. (1974) 0,699(30). For comparision we have :

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0,797(3)</td>
</tr>
<tr>
<td>2</td>
<td>0,798(3)</td>
</tr>
<tr>
<td>3</td>
<td>0,783(11)</td>
</tr>
<tr>
<td>4</td>
<td>0,783(15)</td>
</tr>
<tr>
<td>5</td>
<td>0,799(34)</td>
</tr>
<tr>
<td>6</td>
<td>0,801</td>
</tr>
<tr>
<td>7</td>
<td>0,825(35)</td>
</tr>
<tr>
<td>8</td>
<td>0,8007(18)</td>
</tr>
</tbody>
</table>

Values 3, 4 and 5 are recalculated using the present adopted value of $\alpha_K$.

### 2.2 Gamma Transitions

The gamma energy is taken from Miller et al. (1976).
Multipolarity of the 35.5 keV transition and mixing ratio:

Geiger et al. (1965) compared their measured conversion electron results
\[ L_1/L_2/L_3 = 1/0.089(4)/0.024(2) \]
with the theoretical ratios derived from the table of Sliv and Band and found
99.965(20) % M1 + 0.035(20) % E2.

Mazets et al. (1967) found in the \(^{125}\text{Sb}\) decay
\[ L_1/L_2/L_3 = 10.7/1.0/0.2 \]
 corresponding to
99.92(3) % M1 + 0.08(3) % E2.

Karttunen et al. (1969) deduced from a comparison of experimental results with those of the Hager-Seltzer theory that a possible E2 admixture is smaller than 0.4 %.

Casey et al. (1969) measured \[ L_1/L_2/L_3 = 1/0.106(22)/0.041(2) \]; Coursol (1978/80) more precisely \[ L_1/L_2/L_3 = 1/0.082(4)/0.019(3) \] corresponding to an E2 admixture of 0.03(2) %.

Brabec et al. (1982) have measured
\[ L_1/L_2/L_3 = 1.00(1)/0.0954(18)/0.0229(49) \]
and derived from analysis of these and other data
\[ \delta = 0.029(+ 3 - 2) \] and 99.916(+ 18 - 11) % M1 and 0.084(+ 18 - 11)% E2. These are the here adopted values.

The conversion coefficients of the 35.5 keV transition are compiled in the following table:

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\alpha_K)</td>
<td>11.6(25)</td>
<td>11.78(11)</td>
<td>11.8(3)</td>
<td>11.9(31)</td>
<td>11.75</td>
<td>12.1</td>
<td>12.0</td>
<td>11.9(2)</td>
</tr>
<tr>
<td>(\alpha_L)</td>
<td>1.6(5)</td>
<td>1.62</td>
<td>1.59</td>
<td>1.61(3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(\alpha_M)</td>
<td>0.3(1)</td>
<td>0.25</td>
<td>0.32</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(\alpha_N)</td>
<td>0.044</td>
<td>0.06</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(\alpha_T)</td>
<td>0.006</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(\alpha_\ell)</td>
<td>14.6(26)</td>
<td>13.69(30)</td>
<td>14.25(64)</td>
<td>13.73</td>
<td>14.0(3)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Bowe and Axel (1952); \(\alpha_L\) and \(\alpha_M\) calculated from \(\alpha_K\) and the measured ratio \(K/L/M = 0.80(5)/0.11(2)/0.020(4)\).
2. Karttunen et al. (1969); \(\alpha_K\) recalculated from \(\alpha_K = \omega_K\) with \(\omega_K\) as adopted here. The originally published value is \(\alpha_K = 12.01(18)\). The values of \(\alpha_L, \alpha_M, \alpha_N\) are calculated from \(\alpha_K\) using the ratio \(K/L/M/N = 80/11/17/0.3\) as measured by Narcisi (1959).
3. Marelius et al. (1970)
4. Coursol (1978/80): measured values
5. Brabec et al. (1982). Theoretical values calculated assuming M1 multipolarity with an admixture of 0.087 % E 2 and a nuclear structure parameter \(\lambda = 2.4(14)\).
6. Coursol (1980). Theoretical value calculated within the framework of two models ("Lu": 12.11; "Gaspar": 12.09). An admixture of \((3 \pm 2) \times 10^{-4}\) E 2 as derived from the \(L_1/L_2/L_3\) ratio does not change the value significantly.
7. Theoretical value for \(\alpha_K\) from the tables from Hager and Seltzer (1968) as cited by Coursol (1980).
8. Values adopted by N. Coursol in the LMRI Table de Radionuclidées (1982)

The values 8 are also adopted in the present evaluation as recommended values.

3 Atomic data
The atomic data are taken from Schönheld and Janßen (1996).
3.1 X Radiation

The energy values are calculated from the wavelengths in Å³ as given by Bearden (1967). The relative emission probabilities of K X-rays are taken from Schönfeld and Janßen (1996). The relative emission probabilities of L X-rays is calculated from the value in table 4.2 putting \( P(K_{\alpha_1}) = 1 \).

3.2 Auger Electrons

The energy values are taken from Larkins (1977) (KLL) and the Table de Radionuclides (LMRI 1982) (KLX, KXY). The relative emission probabilities of K Auger electrons are taken from Schönfeld and Janßen (1996). The relative emission probabilities of the L Auger electrons is calculated from the value in the table 4.1 putting \( P(K_{\gamma}) = 1 \).

4 Radiation Emission

4.1 Electron Emission

The energies of the Auger electrons are the same as in 3.2. The energies of the conversion electrons are calculated from the transition energy (2.2) and the binding energies.

The emission probabilities of the conversion electrons are calculated using the conversion coefficients given in 2.2. The values of the emission probabilities of the Auger electrons are calculated using the transition probabilities given in 2.1 and 2.2, the atomic data given in 3 and the conversion coefficients given in 2.2.

4.2 Photon Emission

The energy of the X-rays are the same as in 3.1. For the K X-ray emission probability it was found.

\[
\begin{align*}
1 & \quad 1,379(27) \quad \text{Karttunen et al. (1969)} \\
2 & \quad 1,393(25) \quad \text{Tolea et al. (1974)} \\
3 & \quad 1,379(23) \quad \text{Plch and Zderadicka (1974)} \\
4 & \quad 1,383(20) \quad \text{Konstantinov et al. (1989), recalculated from} \ P(KX + \gamma) = 1.45(2) \\
5 & \quad 1,390(25) \quad \text{evaluated by W. Bambyne in IAEA-TECDOC-619 (1991)} \\
6 & \quad 1,395(20) \quad \text{Here adopted value, calculated from here adopted values of} \ \alpha_K, \ P_K, \ \alpha_K \text{ and } \alpha_t \text{ by} \ P(KX) = \alpha_K(P_K + \alpha'_K) \text{ where} \ \alpha'_K = \alpha_K/(1 + \alpha_t).
\end{align*}
\]

For the \( \gamma \)-ray emission probability \( P_{\gamma} \) (35.5 keV) it was found

\[
\begin{align*}
1 & \quad 0.0655(13) \quad \text{Debertin and Schötzig (1989); Schötzig et al. (1991)} \\
2 & \quad 0.0668(13) \quad \text{Iwahara et al. (1990)} \\
3 & \quad 0.0658(8) \quad \text{recommended by N. Coursol in IAEA-TECDOC-619 (1991)} \\
4 & \quad 0.0666(17) \quad \text{present evaluation; calculated from the values adopted for} \ \alpha_K \text{ and } \alpha_t \text{ by} \ P_{\gamma} = 1 - \alpha'_t \\text{ where} \ \alpha'_t = \alpha_t/(1 + \alpha_t).
\end{align*}
\]

There is good agreement between calculated (adopted) and measured values confirming indirectly the values which are the basis of the calculated values.

5 Main Production Modes

Taken from the „Table de Radionuclides“, LMRI, 1982.

6 References

A. F. Reid, A. S. Keston, Phys. Rev. 70 (1946) 987 \( [T_{1/2}] \)
G. Friedlander, W. C. Orr, Phys. Rev. 48 (1951) 484 \( [T_{1/2}] \)
E. der Mateosian, Phys. Rev. 92 (1953) 938 \( [P_{\text{Lmol}}/P_K] \)
R. S. Narcisi, Thesis Harvard University AECU 4336 (1959) [\(\varepsilon_c\), K/L/M/N]