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Data Section

AN ISOTOPE CATALOGUE FOR INSTRUMENTAL ACTIVATION ANALYSIS,* I

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Introduction

The development of instrumental activation analysis has been assisted by the introduction and use of Ge(Li) γ-ray detectors. Their greater resolving power has encouraged the solution of spectra using the photopeaks alone. In such a scheme, progress has been governed not only by the quality of spectra but also by the accuracy of the relevant published data. For that purpose, among others, γ-ray compilations with an appreciable fraction of better known energies have now appeared.

The following isotope catalogue has been assembled for use with computer programmes for the analysis of γ-ray spectra from neutron activated samples. The principal function of the catalogue is to provide coefficients for isotope activities in a set of linear simultaneous equations. The known quantities are photopeak integrals and the coefficients which are the γ-ray relative intensities for each isotope. The equations are solved for the unknown isotope activities.[1]

The catalogue has been prepared from the sources given[2–11] in conjunction with data from individual papers. Although most of the review was completed by April, 1970, literature has not been disregarded after any particular date. In addition, the values have been taken with a view to consistency between the various sources mentioned rather than giving infinite weight to the most recent figures.

The catalogue is stored on a computer magnetic tape file and programmes are available to list the isotopes in order of Z and A or the γ-rays in order of energy. The isotope version is used by the analysis programmes which to some extent have determined its format. The γ-energy form is a useful supplement when results from the normal computer method are examined.

* B. I. Contribution No. 238.

Description of the isotope catalogue

Half-lives appear in days, corresponding in form to the tape file, and with some rounding error in other units. In the few cases where only an upper or lower limit for half-life is available the limit has been used without comment. Cross-sections are those for (n, γ) thermal production from the target isotope shown with the given isotope abundance. Where ground state decays are fed by short-lived isomers the cross-sections have been increased to allow for production by isomeric decay and in these cases the percentage of the isomer which decays by isomeric transition is given. The cross-sections have not been increased where ground state decays are fed by longer lived isomers or where the error in the ground state cross-section is much greater than the cross-section for isomer production. The decay modes of the isotopes are indicated and the corresponding Q values are given in keV. A limited description of daughter decays is included and is used in programmes to ensure that daughters are not overlooked. In this context a daughter includes the active ground state formed from an isomer. Thus, the direction of chain decays may be ascertained. For similar reasons some isotopes not formed from (n, γ) reactions have the decay modes of their parents included.

The energy format extends to the third decimal place in keV although few energies have been measured to this precision. The corresponding intensities have been calculated from decay schemes using experimental data on conversion where possible. Intensities from 1 to 99999 are allowed corresponding to the range of intensities which might be observed from any isotope in a single detector γ-ray spectrum. The number of γ-rays at some energy emitted per 1 000 disintegrations of the parent may be obtained by multiplying by the appropriate intensity factor.

Energy ordered version: The intensities are given per 1 000 parent decays and where this quantity is less than one a zero appears. The cross-sections and abundances refer to the same isotopes as before.

Discussion

The catalogued decay scheme parameters have been used for γ-radioassay. Correct radioassay and error calculation necessitate the inclusion and use of errors in the catalogued γ-ray intensities. Similarly, the attribution of spectral γ-rays to catalogued isotopes would be more certain if the energy errors were included.

Improvements in the catalogue for instrumental activation analysis will follow improved isotope production data. This includes cross-sections for reactions other than (n, γ), resonance integrals and fission yields where appropriate. All of these can alter with experimental conditions unlike the figures presented here.

It has not been possible in this catalogue to describe completely the ways in which chain decays may proceed. Whilst the decay mode indicators and the half-lives are adequate to calculate the majority of the growth and decay curves, pro-

Table 1

Format of isotope header card

Column, No.	Function	Comments
1— 2	Element symbol	One or two letters, right justified
3— 5	Atomic number	Integer, right justified
6— 8	Mass number	Integer, right justified
9	Metastable state	Letter *M* indicates isomer
10—17	Half-life	E 8.4 format
18	Half-life units	Coded 0 seconds 1 minutes 2 hours 3 days 4 years
19—26	Cross-section	E 8.4 format In units of barns
27—34	Isotope abundance	E 8.4 format Indicates percent abundance of parent stable isotope
35—36	Parent isotope symbol	One or two letters, right justified
37—38	Parent atomic number	Integer, right justified
40—42	Parent mass number	Integer, right justified
43	Decay mode	Decimal code indicates decays 0 β^- 1 β^+ 2 E.C. 3 β^- + E.C. 4 β^+ + E.C. 5 β^+ + β^- + E.C. 6 α 7 Isomeric transition (I.T.) 8 E.C. + I.T. 9 β^- + I.T.
44	γ-Ray emission	Coded 0 no γ-rays 1 γ-rays without cascades 2 cascade γ-rays
45—49	Q_{β^-}	Q value, in keV, for β^- decay Integer right justified
50—54	Unused	
55	Number of levels	Integer, right justified
56—60	Q_{β^+}	Q value, in keV, for β^+ or E.C. decay Integer, right justified
61—65	Q_α	Q value, in keV, for α decay Integer, right justified
66—69	Factor	E 4.0 format. Multiplier to obtain γ-rays per 1000 disintegrations from intensities given on single γ-ray cards
70	Header cards	Integer indicates the number of header cards used for an isotope Otherwise a zero

Table 1 (cont.)

Column, No.	Function	Comments
71	Daughter isotope	Coded 0 stable 1 α decay 2 either or both of β^+ and E.C. 4 β^- 5 β^-, β^+ and E.C.
72	Parent isotope	Coded 3 from β^- 5 from β^+ or E.C. 6 from α
73—76	Production from isomer	F 4 format gives percentage of isomer which decays by isomeric transitions
77—80	Date	Refers to date of most recent review 77—78 month 79—80 year

Table 2

Single γ-ray cards

Column, No.	Function	Comments
1— 9	γ-Ray energy	Integer, units of eV right justified
10—14	γ-Ray intensity	All figures within an isotope set are relative Integer, right justified
15—18	Energy error	Units of eV, integer right justified
19—22	Intensity error	E 4.0 format for standard deviation of γ-ray intensity
73—74	Isotope symbol	Used for identification only
75—77	Mass number	

Table 3

Coincident γ-ray cards

Column, No.	Function	Comments
1— 4	First γ-ray energy	Integer, right justified in keV
5— 8	Second γ-ray energy	Integer, right justified in keV
9—12	Intensity	F 4 format, coincidences per 1000 decays
73—74	Isotope symbol	Used for identification only
75—77	Mass number	

vision for every case requires a suitable description of the level schemes and branching ratios.

Expansion or contraction of the catalogue may be performed using the existing tape files, for example, a catalogue MINICAT with no more than the ten most intense γ-rays for any isotope has been simply prepared. The input card format is given in Tables 1 – 3, and a description of the programmes associated with the compilation is available with the tape file.

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References

1. I. M. H. PAGDEN, G. J. PEARSON, V. N. BECK, I.E.E.E. *Trans. Nucl. Sci. N.S.*, 17 (1970) No. 1. 211.
2. R. C. HAWKINGS, W. J. EDWARDS, E. M. MCLEOD, Tables of Gamma Rays from the Decay of Radionuclides, AECL 1225, 1961.
3. Nuclear Data Sheets, National Academy of Sciences, National Research Council Washington, D.C. to 1966.
4. Nuclear Data, Sections A and B, Wiley, New York, 1967 on.
5. D. J. HUGHES, E. A. MAGURNO, M. K. BRUSSEL, Neutron Cross Sections, BNL 325 and Supplements.
6. The Radiochemical Manual, Part I, The Radiochemical Centre, Amersham, 1962.
7. W. SEELMANN-EGGEBERT, G. P. PFENNIG, H. MÜNZEL, Chart of the Nuclides, 3rd ed. Gersbach und Söhne, Munich, 1968.
8. C. M. LEDERER, J. M. HOLLANDER, I. PERLMAN, Table of the Isotopes, 6th ed., Wiley, New York, 1968.
9. R. L. HEATH, Table of the Isotopes, Handbook of Chemistry and Physics, 50th ed., Chemical Rubber Co., Cleveland, 1969.
10. F. ADAMS, R. DAMS, *J. Radioanal. Chem.*, 3 (1969) 99.
11. F. ADAMS, R. DAMS, *J. Radioanal. Chem.*, 3 (1969) 271.

Listing of isotope catalogue
Part I. $Z=1$ to $Z=48$

Isotope	Half-life	Cross-section	Abundance	Parent	Q^-	Q^+	Q Alpha	Factor
1- H- 3	4.4749E 03 DAYS 1.2260E 01 YEARS DECAY MODE - BETA-MINUS DAUGHTER ISOTOPE STABLE	5.7000E-04 BARNS	1.5000E-02 PC	1- H- 2	0	0	0	0
2- HE- 5	1.1574E-26 DAYS 1.0000E-21 SECONDS DECAY MODE - ALPHA DAUGHTER ISOTOPE STABLE	0 BARNS	0 PC	0- - 0	0	0	0	0
3- LI- 8	9.8380E-06 DAYS 8.500E- 01 SECONDS DECAY MODE - BETA-MINUS DAUGHTER ISOTOPE STABLE	3.3000E-02 BARNS	9.2480E 01 PC	3- LI- 7	0	0	0	0
4- BE- 10	9.8550E 08 DAYS 2.7000E 06 YEARS DECAY MODE - BETA-MINUS DAUGHTER ISOTOPE STABLE	9.0000E-03 BARNS	1.0000E 02 PC	4- BE- 9	0	0	0	0
5- B- 12	2.3148E-07 DAYS 2.0000E-02 SECONDS	5.0000E-03 BARNS	8.0000E 01 PC	5- B- 11	0	0	0	0

DECAY MODE – BETA-MINUS
DAUGHTER ISOTOPE STABLE

6– C– 14	2.1024E 06 DAYS 5.7600E 03 YEARS	9.0000E–04 BARNS	1.1080E 00 PC	6– C– 13	0	0	0	0

DECAY MODE – BETA-MINUS
DAUGHTER ISOTOPE STABLE

7– N– 16	8.5648E–05 DAYS 7.4000E 00 SECONDS	2.4000E–05 BARNS	3.6500E–01 PC	7– N– 15	0	0	0	6.8000E–02

DECAY MODE – BETA-MINUS
DAUGHTER ISOTOPE STABLE
5 SINGLE GAMMAS

1720.000	0
1900.000	0
2750.000	150
6128.900	10000
7117.000	700

8– O– 19	3.3565E–04 DAYS 2.9000E 01 SECONDS	2.1000E–04 BARNS	2.0400E–01 PC	8– O– 18	4818	0	0	1.6000E–02

DECAY MODE – BETA-MINUS
DAUGHTER ISOTOPE STABLE
4 SINGLE GAMMAS

112.000	2000
197.400	60000
1370.000	36000
1440.000	2000

Isotope	Half-life	Cross-section	Abundance	Parent	Q^-	Q^+	Q Alpha	Factor
9– F– 20	1.2963E–04 DAYS 1.1200E 01 SECONDS	9.8000E–03 BARNS	1.0000E 02 PC	9– F– 19	0	0	0	1.0000E–01
	DECAY MODE – BETA-MINUS DAUGHTER ISOTOPE STABLE							
	1 SINGLE GAMMA							
	1627.000	10000						
10–NE– 23	4.3981E–04 DAYS 3.8000E 01 SECONDS	3.6000E–02 BARNS	8.8200E 00 PC	10–NE– 22	4380	0	0	3.3000E–02
	DECAY MODE – BETA-MINUS DAUGHTER ISOTOPE STABLE							
	8 SINGLE GAMMAS							
	440.000	10000						
	1630.000	280						
	1960.000	4						
	2070.000	30						
	2270.000	2						
	2550.000	8						
	2870.000	1						
	2990.000	9						
11–NA– 22	9.4900E 02 DAYS 2.6000E 00 YEARS	0 BARNS	0 PC	0– – 0	0	2842	0	1.0000E–02
	DECAY MODE – BETA-PLUS + ELECTRON CAPTURE DAUGHTER ISOTOPE STABLE							
	1 SINGLE GAMMA							
	1274.520	99940						

11–NA– 24	6.2500E–01 DAYS 1.5000E 01 HOURS	5.3000E–01 BARNS	1.0000E 02 PC	11–NA– 23	5516	0	0	1.0000E–01
	DECAY MODE – BETA-MINUS DAUGHTER ISOTOPE STABLE							
	4 SINGLE GAMMAS							
		1368.650	10000					
		2754.100	10000					
		3850.000	9					
		4230.000	0					
12–MG– 27	6.5972E–03 DAYS 9.5000E 00 MINUTES	3.0000E–02 BARNS	1.1170E 01 PC	12–MG– 26	2618	0	0	1.0000E–02
	DECAY MODE – BETA-MINUS DAUGHTER ISOTOPE STABLE							
	3 SINGLE GAMMAS							
		170.000	700					
		844.000	70000					
		1014.100	30000					
13–AL– 28	1.5972E–03 DAYS 2.3000E 00 MINUTES	2.3200E–01 BARNS	1.0000E 02 PC	13–AL– 27	4640	0	0	1.0000E–01
	DECAY MODE – BETA-MINUS DAUGHTER ISOTOPE STABLE							
	1 SINGLE GAMMA							
		1778.900	10000					
13–AL– 29	4.5833E–03 DAYS 6.6000E 00 MINUTES	0 BARNS	0 PC	0– – 0	3680	0	0	1.0000E–02

Isotope	Half-life	Cross-section	Abundance	Parent	Q^-	Q^+	Q Alpha	Factor
13– AL– 29	DECAY MODE – BETA-MINUS DAUGHTER ISOTOPE STABLE 2 SINGLE GAMMAS							
		2425.800 15000 1273.300 85000						
14– SI– 31	1.0833E–01 DAYS 2.6000E 00 HOURS	1.1000E–01 BARNS	3.0500E 00 PC	14– SI– 30	1477	0	0	7.0000E–05
	DECAY MODE – BETA-MINUS DAUGHTER ISOTOPE STABLE 1 SINGLE GAMMA							
		1266.000 10000						
15– P– 32	1.4300E 01 DAYS	1.9000E–01 BARNS	1.0000E 02 PC	15– P– 31	1708	0	0	0
	DECAY MODE – BETA-MINUS DAUGHTER ISOTOPE STABLE							
16– S– 35	8.7000E 01 DAYS	2.6000E–01 BARNS	4.2150E 00 PC	16– S– 34	167	0	0	0
	DECAY MODE – BETA-MINUS DAUGHTER ISOTOPE STABLE							
16– S– 37	3.5417E–03 DAYS 5.1000E 00 MINUTES	1.4000E–01 BARNS	1.7000E–02 PC	16– S– 36	4790	0	0	9.0000E–02
	DECAY MODE – BETA-MINUS DAUGHTER ISOTOPE STABLE 1 SINGLE GAMMA							
		3102.400 10000						

17–CL– 36	1.1300E 07 DAYS 3.0959E 04 YEARS	4.4000E 01 BARNS	7.5530E 01 PC	17–CL– 35	712	0	0	0
	DECAY MODE – BETA-PLUS + BETA-MINUS + ELECTRON CAPTURE DAUGHTER ISOTOPE STABLE							
17–CL– 38	2.5903E–02 DAYS 3.7300E 01 MINUTES	4.3000E–01 BARNS	2.4470E 01 PC	17–CL– 37	4916	0	0	1.0000E–02
	DECAY MODE – BETA-MINUS DAUGHTER ISOTOPE STABLE							
	2 SINGLE GAMMAS 1642.000 38000 2166.800 47000							
18–AR– 37	3.5000E 01 DAYS	6.0000E 00 BARNS	3.3700E–01 PC	18–AR– 36	816	0	0	0
	DECAY MODE – BETA-PLUS + ELECTRON CAPTURE DAUGHTER ISOTOPE STABLE							
18–AR– 39	9.6725E 04 DAYS 2.6500E 02 YEARS	8.0000E–01 BARNS	6.3000E–02 PC	18–AR– 38	565	0	0	0
	DECAY MODE – BETA-MINUS DAUGHTER ISOTOPE STABLE							
18–AR– 41	7.6250E 02 DAYS 1.8300E 00 HOURS	6.5000E–01 BARNS	9.9600E 01 PC	18–AR– 40	2490	2	0	9.9000E–02
	DECAY MODE – BETA-MINUS DAUGHTER ISOTOPE STABLE							
	1 SINGLE GAMMA 1293.600 10000							

Isotope	Half-life	Cross-section	Abundance	Parent	Q^-	Q^+	Q Alpha	Factor
19– K– 40	4.7450E 11 DAYS 1.3000E 09 YEARS	2.2000E 00 BARNS	9.3080E 01 PC	19– K– 39	1321	0	0	1.1000E–02
	DECAY MODE – BETA-PLUS + BETA-MINUS + ELECTRON CAPTURE DAUGHTER ISOTOPE STABLE							
	1 SINGLE GAMMA 1460.700 10000							
19– K– 42	5.2083E–01 DAYS 1.2500E 01 HOURS	1.3000E 00 BARNS	6.8800E 00 PC	19– K– 41	3530	0	0	1.8000E–02
	DECAY MODE – BETA-MINUS DAUGHTER ISOTOPE STABLE							
	5 SINGLE GAMMAS 312.900 100 1524.700 10000 1920.000 0 2450.000 0 2720.000 0							
20–CA– 41	2.9200E 07 DAYS 8.0000E 04 YEARS	4.3000E–01 BARNS	9.6970E 01 PC	20–CA 40	413	0	0	0
	DECAY MODE – BETA-PLUS + ELECTRON CAPTURE DAUGHTER ISOTOPE STABLE							
20–CA– 45	1.6500E 02 DAYS	1.1000E 00 BARNS	2.0600E 00 PC	20–CA– 44	252	0	0	0
	DECAY MODE – BETA-MINUS DAUGHTER ISOTOPE STABLE							

20–CA– 47	4.5300E 00 DAYS	2.5000E–01 BARNS	3.3000E–03 PC	20–CA– 46	1965	0	0	9.1000E–03

DECAY MODE – BETA-MINUS
DAUGHTER ISOTOPE DECAYS BY BETA-MINUS

3 SINGLE GAMMAS

489.500	8000
807.400	8000
1296.900	90000

20–CA– 49	5.9028E–03 DAYS	1.1000E 00 BARNS	1.8500E–01 PC	20–CA– 48	5250	0	0	1.0000E–02

8.5000E 00 MINUTES

DECAY MODE – BETA-MINUS
DAUGHTER ISOTOPE DECAYS BY BETA-MINUS

3 SINGLE GAMMAS

3083.000	89000
4071.000	10000
4680.000	300

21–SC– 46	8.4000E 01 DAYS	2.3000E 01 BARNS	1.0000E 02 PC	21–SC– 45	2365	0	0	1.0000E–01

DECAY MODE – BETA-MINUS
DAUGHTER ISOTOPE STABLE

100.00 PERCENT OF THE ISOMER DEEXCITES BY THE ISOMERIC TRANSITION TO THIS STATE

2 SINGLE GAMMAS

889.250	10000
1120.500	10000

2 LEVELS

887	7.000E–12 SECONDS
2006	3.000E–11 SECONDS

Isotope	Half-life	Cross-section	Abundance	Parent	Q^-	ε^+	Q Alpha	Factor
21–SC– 46M	2.3148E–04 DAYS	1.1000E 01 BARNS	1.0000E 02 PC	21–SC– 45	0	0	0	0
	2.0000E 01 SECONDS							
	DECAY MODE – ISOMERIC TRANSITION DAUGHTER ISOTOPE DECAYS BY BETA-MINUS							
	1 SINGLE GAMMA							
	142.500	0						
21–SC– 47	3.4000E 00 DAYS	0 BARNS	0 PC	0– – 0	600	0	0	1.0000E–02
	DECAY MODE – BETA-MINUS DAUGHTER ISOTOPE STABLE							
	1 SINGLE GAMMA							
	159.380	73000						
21–SC– 48	1.8300E 00 DAYS	0 BARNS	0 PC	0– – 0	3990	0	0	1.0000E–01
	4.3920E 01 HOURS							
	DECAY MODE – BETA-MINUS DAUGHTER ISOTOPE STABLE							
	4 SINGLE GAMMAS							
	175.400	600						
	983.460	10000						
	1037.500	10000						
	1311.900	10000						
21–SC– 49	3.9931E–02 DAYS	0 BARNS	0 PC	0– – 0	0	0	0	1.0000E–02
	5.7500E 01 MINUTES							

DECAY MODE – BETA-MINUS
DAUGHTER ISOTOPE STABLE

1 SINGLE GAMMA

1780.000	30

22– TI– 51	4.0278E–03 DAYS	1.4000E–01 BARNS	5.3400E 00 PC	22– TI– 50	2470	0	0	1.0000E–02

5.8000E 00 MINUTES

DECAY MODE – BETA-MINUS
DAUGHTER ISOTOPE STABLE

3 SINGLE GAMMAS

320.000	95500
608.400	1500
928.500	4500

23– V– 52	2.6389E–03 DAYS	4.8000E 00 BARNS	9.9760E 01 PC	23– V– 52	3994	0	0	1.0000E–02

3.8000E 00 MINUTES

DECAY MODE – BETA-MINUS
DAUGHTER ISOTOPE STABLE

1 SINGLE GAMMA

1434.400	99000

24–CR– 51	2.7800E 01 DAYS	1.6000E 01 BARNS	4.3100E 00 PC	24–CR– 50	752	0	0	1.0000E–03

DECAY MODE – BETA-PLUS + ELECTRON CAPTURE
DAUGHTER ISOTOPE STABLE

1 SINGLE GAMMA

320.080	90000

Isotope	Half-life	Cross-section	Abundance	Parent	Q^-	Q^+	Q Alpha	Factor
24–CR– 55	2.5000E–03 DAYS 3.6000E 00 MINUTES	3.8000E–01 BARNS	2.3800E 00 PC	24–CR– 54	2850	0	0	0
	DECAY MODE – BETA-MINUS DAUGHTER ISOTOPE STABLE							
25–MN– 54	3.1300E 02 DAYS	0 BARNS	0 PC	0– – 0	0	1379	0	1.0000E–01
	DECAY MODE – ELECTRON CAPTURE DAUGHTER ISOTOPE STABLE							
	1 SINGLE GAMMA							
	834.800 10000							
25–MN– 56	1.0750E–01 DAYS 2.5800E 00 HOURS	1.3300E 01 BARNS	1.0000E 02 PC	25–MN– 55	3700	0	0	9.9000E–02
	DECAY MODE – BETA-MINUS DAUGHTER ISOTOPE STABLE							
	7 SINGLE GAMMAS							
	846.780 10000							
	1810.960 3000							
	2113.200 1530							
	2520.000 120							
	2657.240 70							
	2959.800 40							
	3367.000 21							
26– FE– 55	9.4900E 02 DAYS 2.6000E 00 YEARS	2.8000E 00 BARNS	5.8400E 00 PC	26– FE– 54	231	0	0	0

DECAY MODE – BETA-PLUS + ELECTRON CAPTURE
DAUGHTER ISOTOPE STABLE

26–FE– 59	4.5000E 01 DAYS	1.2300E 00 BARNS	3.3000E–01 PC	26–FE– 58	1563	0	0	1.0000E–02

DECAY MODE – BETA-MINUS
DAUGHTER ISOTOPE STABLE

5 SINGLE GAMMAS

142.450	800
192.230	2500
334.810	300
1099.270	56000
1291.580	44000

27–CO– 57	2.7000E 02 DAYS	0 BARNS	0 PC	0– – 0	0	837	0	1.0000E–02

DECAY MODE – ELECTRON CAPTURE
DAUGHTER ISOTOPE STABLE

10 SINGLE GAMMAS

14.410	8400
122.060	85000
136.471	11000
231.000	0
339.700	4
352.400	3
366.700	0
570.300	14
692.100	160
706.800	6

27–CO– 58	7.1300E 01 DAYS	0 BARNS	0 PC	0– – 0	0	2309	0	1.0000E–01

DECAY MODE – BETA-PLUS + ELECTRON CAPTURE
DAUGHTER ISOTOPE STABLE

Isotope	Half-life	Cross-section	Abundance	Parent	Q^-	Q^+	Q Alpha	Factor
27–CO–58	3 SINGLE GAMMAS							
		810.810 10000						
		864.020 138						
		1674.940 61						
27–CO–60	1.9163E 03 DAYS	3.7000E 01 BARNS	1.0000E 02 PC	27–CO– 59	2816	0	0	1.0000E–01
	5.2500E 00 YEARS							
	DECAY MODE – BETA-MINUS							
	DAUGHTER ISOTOPE STABLE							
	99.00 PERCENT OF THE ISOMER DEEXCITES BY THE ISOMERIC TRANSITION TO THIS STATE							
	3 SINGLE GAMMAS							
		1173.226 9988						
		1332.483 10000						
		2158.000 0						
27–CO– 60M	7.2917E–03 DAYS	1.9900E 01 BARNS	1.0000E 02 PC	27–CO– 59	0	0	0	1.0000E–03
	1.0500E 01 MINUTES							
	DECAY MODE – BETA-MINUS + ISOMERIC TRANSITION							
	DAUGHTER ISOTOPE DECAYS BY BETA-MINUS							
	4 SINGLE GAMMAS							
		58.600 20000						
		830.000 80						
		1332.483 2500						
		2160.000 8						
28– NI– 57	1.5417E 00 DAYS	0 BARNS	0 PC	0 – 0	0	3240	0	1.0000E–02
	3.7000E 01 HOURS							

DECAY MODE – BETA-PLUS + ELECTRON CAPTURE
DAUGHTER ISOTOPE DECAYS BY ONE OR BOTH OF BETA-PLUS AND E.C.

5 SINGLE GAMMAS

129.300	14000
1377.600	86000
1757.800	6000
1783.000	1000
1882.400	8000

28– NI– 59	2.7375E 07 DAYS 7.5000E 04 YEARS	4.4000E 00 BARNS	6.7760E 01 PC	28– NI– 58	1076	0	0	0

DECAY MODE – ELECTRON CAPTURE
DAUGHTER ISOTOPE STABLE

28– NI– 63	3.3580E 04 DAYS 9.2000E 01 YEARS	1.5000E 01 BARNS	3.6600E 00 PC	28– NI– 62	67	0	0	0

DECAY MODE – BETA-MINUS
DAUGHTER ISOTOPE STABLE

28– NI– 65	1.0504E–01 DAYS 2.5210E 00 HOURS	1.5200E 00 BARNS	1.0800E 00 PC	28– NI– 64	2100	0	0	3.4000E–02

DECAY MODE – BETA-MINUS
DAUGHTER ISOTOPE STABLE

5 SINGLE GAMMAS

366.500	4400
1115.400	16100
1481.700	24600
1625.000	700
1725.000	400

Isotope	Half-life	Cross-section	Abundance	Parent	Q^-	Q^+	Q Alpha	Factor
29–CU– 64	5.3333E–01 DAYS 1.2800E 01 HOURS	4.5000E 00 BARNS	6.9100E 01 PC	29–CU– 63	1678	0	0	5.0000E–04
	DECAY MODE – BETA-PLUS + BETA-MINUS + ELECTRON CAPTURE DAUGHTER ISOTOPE STABLE							
	1 SINGLE GAMMA 1345.500 10000							
29–CU– 66	3.5417E–03 DAYS 5.1000E 00 MINUTES	2.3000E 00 BARNS	3.0910E 01 PC	29–CU– 65	2630	0	0	1.0000E–03
	DECAY MODE – BETA-MINUS DAUGHTER ISOTOPE STABLE							
	2 SINGLE GAMMAS 833.600 2500 1039.000 92500							
29–CU– 67	2.5783E 00 DAYS 6.1880E 01 HOURS	0 BARNS	0 PC	0– – 0	577	0	0	1.0000E–02
	DECAY MODE – BETA-MINUS DAUGHTER ISOTOPE STABLE							
	6 SINGLE GAMMAS 91.260 6200 93.310 35000 184.600 45000 209.000 90 300.200 600 393.600 200							

30-ZN- 65	2.4380E 02 DAYS	8.2000E-01 BARNS	4.8900E 01 PC	30-ZN- 64	1348	0	0	1.0000E-02

DECAY MODE - BETA-PLUS + ELECTRON CAPTURE
DAUGHTER ISOTOPE STABLE

3 SINGLE GAMMAS

1115.510	50600
344.000	3
771.000	3

30-ZN- 69	3.8194E-02 DAYS	1.0000E 00 BARNS	1.8560E 01 PC	30-ZN- 68	900	0	0	0

5.5000E 01 MINUTES

DECAY MODE - BETA-MINUS
DAUGHTER ISOTOPE STABLE

30-ZN- 69M	5.7917E-01 DAYS	9.7000E-02 BARNS	1.8560E 01 PC	30-ZN- 68	0	0	0	9.5000E-02

1.3900E 01 HOURS

DECAY MODE - ISOMERIC TRANSITION
DAUGHTER ISOTOPE DECAYS BY BETA-MINUS

1 SINGLE GAMMA

438.700	10000

30-ZN- 71	1.6667E-03 DAYS	9.0000E-02 BARNS	6.2000E-01 PC	30-ZN- 70	2900	0	0	1.0000E-02

2.4000E 00 MINUTES

DECAY MODE - BETA-MINUS
DAUGHTER ISOTOPE STABLE

4 SINGLE GAMMAS

121.800	1300
511.600	14200
910.100	3100
1120.000	1300

Isotope	Half-life	Cross-section	Abundance	Parent	Q^-	Q^+	Q Alpha	Factor
30-ZN- 71M	1.6250E-01 DAYS 3.9000E 00 HOURS	9.0000E-03 BARNS	6.2000E-01 PC	30-ZN- 70	2980	0	0	1.0000E-01
	DECAY MODE - BETA-MINUS DAUGHTER ISOTOPE STABLE							
	3 SINGLE GAMMAS							
		380.000	10000					
		490.000	10000					
		610.000	10000					
31-GA- 70	1.4583E-02 DAYS 2.1000E 01 MINUTES	1.8000E 00 BARNS	6.0400E 01 PC	31-GA- 69	1650	0	0	4.0000E-05
	DECAY MODE - BETA-MINUS DAUGHTER ISOTOPE STABLE							
	3 SINGLE GAMMAS							
		173.000	27200					
		1042.000	72400					
		1215.000	400					
31-GA- 72	5.8333E-01 DAYS 1.4000E 01 HOURS	5.0000E 00 BARNS	3.9600E 01 PC	31-GA- 71	4000	0	0	1.0000E-02
	DECAY MODE - BETA-MINUS DAUGHTER ISOTOPE STABLE							
	15 SINGLE GAMMAS							
		601.100	7900					
		630.100	26300					
		786.500	3900					
		810.500	3700					

		834.100	96200						
		894.300	12100						
		1050.600	6900						
		1260.400	1300						
		1276.500	1700						
		1464.200	3300						
		1596.200	4200						
		1860.400	5900						
		2201.400	27300						
		2490.500	6800						
		2507.400	13300						
32-GE- 71	1.1400E 01 DAYS	3.4000E 00 BARNS		2.0550E 01 PC	32-GE- 70	0	233	0	0
	DECAY MODE – BETA-PLUS + ELECTRON CAPTURE DAUGHTER ISOTOPE STABLE								
32-GE- 75	5.6944E-02 DAYS 1.3667E 00 HOURS	2.4600E-01 BARNS		3.6540E 01 PC	32-GE- 74	1190	0	0	1.1000E-02
	DECAY MODE – BETA-MINUS DAUGHTER ISOTOPE STABLE								
	100.00 PERCENT OF THE ISOMER DEEXCITES BY THE ISOMERIC TRANSITION TO THIS STATE								
	6 SINGLE GAMMAS								
		66.700	300						
		198.600	1200						
		264.600	10000						
		420.000	300						
		470.000	300						
		620.000	100						
32-GE- 75M	5.6713E-04 DAYS 4.9000E 01 SECONDS	4.0000E-02 BARNS		3.6740E 01 PC	32-GE-74	0	0	0	1.0000E-02

Isotope	Half-life	Cross-section	Abundance	Parent	Q^-	Q^+	Q Alpha	Factor
32-GE- 75M	DECAY MODE - ISOMERIC TRANSITION DAUGHTER ISOTOPE DECAYS BY BETA-MINUS							
	1 SINGLE GAMMA							
		139.800 34800						
32-GE- 77	4.5833E-01 DAYS 1.1000E 01 HOURS	1.0000E-01 BARNS	7.7600E 00 PC	32-GE- 76	2750	0	0	3.1000E-02
	DECAY MODE - BETA-MINUS DAUGHTER ISOTOPE DECAYS BY BETA-MINUS							
	24.00 PERCENT OF THE ISOMER DEEXCITES BY THE ISOMERIC TRANSITION TO THIS STATE							
	82 SINGLE GAMMAS							
		156.300 163						
		177.400 10						
		194.900 485						
		211.030 9980						
		215.510 8710						
		255.000 26						
		264.450 17000						
		338.500 308						
		367.490 4850						
		416.350 8150						
		439.500 103						
		461.400 419						
		475.500 359						
		557.700 5690						
		582.500 255						
		613.600 239						
		624.600 20						
		632.300 3140						
		673.100 219						

698.800	83
714.100	2690
743.200	48
745.600	352
749.900	326
766.800	260
781.300	335
784.800	409
794.700	49
810.600	781
823.600	209
843.700	79
875.300	260
907.200	223
914.200	42
922.900	168
925.500	262
929.100	292
939.600	65
946.900	4
959.100	26
968.100	24
986.300	23
997.100	23
1062.100	14
1085.000	2160
1115.400	31
1125.700	30
1151.800	62
1193.300	862
1202.700	20
1216.000	35
1242.400	104
1264.200	267
1280.800	34
1296.300	29

Isotope	Half-life	Cross-section		Abundance	Parent	Q^-	Q^+	Q Alpha	Factor
32–GE– 77		1309.500	161						
		1313.100	92						
		1319.800	135						
		1368.500	905						
		1452.600	59						
		1464.800	55						
		1477.100	111						
		1479.900	83						
		1495.100	186						
		1529.000	21						
		1539.400	49						
		1573.300	227						
		1709.600	104						
		1719.700	147						
		1726.900	42						
		1830.900	15						
		1846.500	54						
		1879.900	10						
		1928.800	7						
		2000.100	192						
		2038.500	12						
		2077.400	80						
		2089.700	73						
		2126.500	48						
		2248.000	7						
		2329.400	8						
		2341.500	164						
32 GE– 77M	6.2500E-04 DAYS 5.4000E 01 SECONDS	8.0000E-02 BARNS		7.6700E 00 PC	32–GE– 76	2910	0	0	2.1000E-02

DECAY MODE – BETA-MINUS + ISOMERIC TRANSITION
DAUGHTER ISOTOPE DECAYS BY BETA-MINUS

2 SINGLE GAMMAS

159.800	5500
215.500	10000

33-AS-74 1.7900E 01 DAYS 0 BARNS 0 PC 0- - 0 1360 2530 0 5.5000E-02

DECAY MODE - BETA-PLUS + BETA-MINUS + ELECTRON CAPTURE
DAUGHTER ISOTOPE STABLE

8 SINGLE GAMMAS

595.860	10000
608.400	20
634.730	2560
887.200	4
993.600	2
1204.000	47
1604.000	1
2198.800	1

33-AS-76 1.1042E 00 DAYS 4.3000E 00 BARNS 1.0000E 02 PC 33-AS-75 2970 1100 0 4.4000E-02

2.6500E 01 HOURS

DECAY MODE - BETA-MINUS
DAUGHTER ISOTOPE STABLE

23 SINGLE GAMMAS

510.000	50
559.100	10000
562.800	100
657.040	1500
665.400	0
708.000	30
740.000	50
775.000	40
858.000	30

Isotope	Half-life	Cross-section		Abundance	Parent	Q^-	Q^+	Q Alpha	Factor
33- AS- 76		869.000	24						
		1213.300	0						
		1216.250	1000						
		1220.000	200						
		1228.630	230						
		1439.400	120						
		1453.000	54						
		1550.000	20						
		1789.800	77						
		1880.000	20						
		2096.600	130						
		2111.100	73						
		2434.000	5						
		2656.000	8						
33- AS- 77	1.6250E 00 DAYS	0 BARNS		0 PC	0- - 0	684	0	0	1.5000E-03
	3.9000E 01 HOURS								
	DECAY MODE - BETA-MINUS								
	DAUGHTER ISOTOPE STABLE								
	6 SINGLE GAMMAS								
		87.860	2600						
		161.860	3400						
		238.960	16500						
		270.740	80						
		281.630	600						
		520.630	6100						
34- SE- 75	1.2040E 02 DAYS	3.0000E 01 BARNS		8.7000E-01 PC	34- SE- 74	0	865	0	6.3000E-02
	DECAY MODE - ELECTRON CAPTURE								
	DAUGHTER ISOTOPE STABLE								

13 SINGLE GAMMAS

24.300	0
66.050	160
96.731	560
121.113	2800
135.998	9600
198.600	240
264.648	10000
279.522	4200
303.892	230
400.641	2000
427.000	2
572.000	16
628.000	1

34- SE- 77M	2.0255E-04 DAYS 1.7500E 01 SECONDS	2.100E 01 BARNS	9.0200E 00 PC	34- SE- 76	0	0	0	1.0000E-02

DECAY MODE - ISOMERIC TRANSITION
DAUGHTER ISOTOPE STABLE

1 SINGLE GAMMA

161.900	50600

34- SE- 79	2.3725E 07 DAYS 6.5000E 04 YEARS	5.6000E-01 BARNS	2.3520E 01 PC	34- SE- 78	160	0	0	0

DECAY MODE - BETA-MINUS
DAUGHTER ISOTOPE STABLE

100.00 PERCENT OF THE ISOMER DEEXCITES BY THE ISOMERIC TRANSITION TO THIS STATE

34- SE- 79M	2.7083E-03 DAYS 3.9000E 00 MINUTES	3.6000E-01 BARNS	2.3520E 01 PC	34- SE- 78	0	0	0	1.0000E-02

Isotope	Half-life	Cross-section	Abundance	Parent	Q^-	Q^+	Q Alpha	Factor
34- SE- 79M	DECAY MODE - ISOMERIC TRANSITION DAUGHTER ISOTOPE DECAYS BY BETA-MINUS							
	1 SINGLE GAMMA							
		95.900 10000						
34- SE- 81	1.2917E-02 DAYS	5.0000E-01 BARNS	4.9820E 01 PC	34- SE- 80	1580		0 0	8.2000E-05
	1.8600E 01 MINUTES							
	DECAY MODE - BETA-MINUS DAUGHTER ISOTOPE STABLE							
	9 SINGLE GAMMAS							
		179.000 190						
		260.700 1000						
		276.100 10200						
		290.200 8400						
		538.700 700						
		552.400 1500						
		566.200 3600						
		649.600 540						
		828.300 3900						
34- SE- 81M	3.9583E-02 DAYS	8.0000E-02 BARNS	4.9820E 01 PC	34- SE- 80	1400		0 0	8.0000E-03
	5.7000E 01 MINUTES							
	DECAY MODE - ISOMERIC TRANSITION DAUGHTER ISOTOPE DECAYS BY BETA-MINUS							
	1 SINGLE GAMMA							
		103.000 10000						

34- SE- 83	1.5972E-02 DAYS 2.3000E 01 MINUTES	4.0000E-03 BARNS	9.1900E 00 PC	34- SE- 82	2800	0	0	1.0000E-02

DECAY MODE - BETA-MINUS
DAUGHTER ISOTOPE DECAYS BY BETA-MINUS
26 SINGLE GAMMAS

226.000	31000
356.000	73000
457.000	3500
512.000	45000
554.000	3000
676.000	13000
720.000	22000
801.000	15000
837.000	14000
866.000	9000
1065.000	6000
1082.000	2000
1192.000	4000
1299.000	9000
1319.000	4000
1344.000	6000
1355.000	3000
1421.000	700
1558.000	3000
1784.000	4000
1830.000	1300
1855.000	3000
1897.000	9000
2291.000	12000
2338.000	4000
2421.000	1000

35-BR- 80	1.2500E-02 DAYS 1.8000E 01 MINUTES	8.5000E 00 BARNS	5.0537E 01 PC	35-BR- 79	2000	1888	0	1.0000E-03

Isotope	Half-life	Cross-section	Abundance	Parent	Q^-	Q^+	Q Alpha	Factor
35-BR- 80	DECAY MODE – BETA-PLUS + BETA-MINUS + ELECTRON CAPTURE DAUGHTER ISOTOPE STABLE							
	5 SINGLE GAMMAS							
		617.000	63000					
		640.400	2000					
		665.700	10500					
		704.300	1400					
		1256.700	1000					
35-BR- 80M	1.8750E-01 DAYS 4.5000E 00 HOURS	2.9000E 00 BARNS	5.0537E 01 PC	35-BR- 79	85	0	0	4.2000E-02
	DECAY MODE – ISOMERIC TRANSITION DAUGHTER ISOTOPE DECAYS BY BETA-MINUS							
	2 SINGLE GAMMAS							
		37.000	10000					
		49.000	90					
35-BR- 82	1.4792E 00 DAYS 3.5500E 01 HOURS	3.2600E 00 BARNS	4.9463E 01 PC	35-BR- 81	3092	0	0	3.1000E-03
	DECAY MODE – BETA-MINUS DAUGHTER ISOTOPE STABLE							
	23 SINGLE GAMMAS							
		92.300	400					
		100.900	0					
		137.100	0					
		221.280	2300					
		273.220	1200					
		295.500	0					
		452.900	0					

	554.240	73000							
	606.230	0							
	619.020	43000							
	698.300	27000							
	776.450	83000							
	827.800	24000							
	1007.550	0							
	1044.020	29000							
	1084.000	400							
	1317.520	28000							
	1474.930	17000							
	1650.500	800							
	1777.600	120							
	1874.000	50							
	1959.000	50							
	2056.000	20							
35-BR- 83	9.5833E-02 DAYS	0 BARNS	0 PC	0- - 0	1000	0	0	1.0000E-03	
	2.3000E 00 HOURS								
	DECAY MODE - BETA-MINUS DAUGHTER ISOTOPE STABLE								
	4 SINGLE GAMMAS								
	9.000	0							
	32.000	0							
	520.700	0							
	529.500	14000							
36-KR- 79	1.4375E 00 DAYS	2.0000E 00 BARNS	3.5400E-01 PC	36-KR- 78	0	1620	0	8.0000E-03	
	3.4500E 01 HOURS								
	DECAY MODE - BETA-PLUS + ELECTRON CAPTURE DAUGHTER ISOTOPE STABLE								

Isotope	Half-life	Cross-section	Abundance	Parent	Q^-	Q^+	Q Alpha	Factor
36-KR- 79	26 SINGLE GAMMAS							
		44.000 0						
		136.000 700						
		181.000 80						
		208.500 700						
		217.300 2000						
		261.300 11500						
		299.700 1300						
		306.700 2500						
		308.000 0						
		345.000 100						
		389.100 1600						
		397.400 10100						
		523.000 300						
		526.000 200						
		606.500 8300						
		616.000 100						
		726.000 50						
		810.000 140						
		833.000 1700						
		860.000 80						
		935.000 100						
		1026.000 130						
		1072.000 90						
		1115.000 400						
		1165.000 90						
		1332.000 500						
36-KR- 79M	6.3657E-04 DAYS	0 BARNS	3.5400E-01 PC	36-KR- 78	0	0	0	0
	5.5000E 01 SECONDS							

DECAY MODE - ISOMERIC TRANSITION
DAUGHTER ISOTOPE DECAYS BY ONE OR BOTH OF BETA-PLUS AND E.C.

1 SINGLE GAMMA
127.000 10000

36–KR– 81	7.6650E 07 DAYS 2.1000E 05 YEARS	1.4000E 01 BARNS	2.2700E 00 PC	36–KR– 80	0	300	0		0

DECAY MODE – ELECTRON CAPTURE
DAUGHTER ISOTOPE STABLE
100.00 PERCENT OF THE ISOMER DEEXCITES BY THE ISOMERIC TRANSITION TO THIS STATE

36–KR– 81M	1.5046E–04 DAYS 1.3000E 01 SECONDS	1.4000E 01 BARNS	2.2700E 00 PC	36–KR– 80	0	0	0	6.7000E–02	

DECAY MODE – ISOMERIC TRANSITION
DAUGHTER ISOTOPE DECAYS BY ONE OR BOTH OF BETA-PLUS AND E.C.
1 SINGLE GAMMA
190.000 10000

36–KR– 83M	7.9167E–02 DAYS 1.9000E 00 HOURS	1.8000E 02 BARNS	1.1560E 01 PC	36–KR– 82	0	0	0		0

DECAY MODE – ISOMERIC TRANSITION
DAUGHTER ISOTOPE STABLE
2 SINGLE GAMMAS
32.000 0
9.300 0

36–KR– 85	3.8690E 03 DAYS 1.0600E 01 YEARS	6.5000E–02 BARNS	5.6900E 01 PC	36–KR– 84	672	0	0	1.0000E–04	

Isotope	Half-life	Cross-section	Abundance	Parent	Q^-	Q^+	Q Alpha	Factor
36-KR- 85	DECAY MODE - BETA-MINUS DAUGHTER ISOTOPE STABLE							
	23.00 PERCENT OF THE ISOMER DEEXCITES BY THE ISOMERIC TRANSITION TO THIS STATE							
	1 SINGLE GAMMA 514.000 41000							
36-KR- 85M	1.8333E-01 DAYS 4.4000E 00 HOURS	1.0000E-01 BARNS	5.6900E 01 PC	36-KR- 84	907	0	0	1.0000E-02
	DECAY MODE - BETA-MINUS + ISOMERIC TRANSITION DAUGHTER ISOTOPE DECAYS BY BETA-MINUS							
	2 SINGLE GAMMAS 151.200 74000 305.000 15500							
36-KR- 87	5.2778E-02 DAYS 1.2667E 00 HOURS	6.0000E-02 BARNS	1.7370E 01 PC	36-KR- 86	3960	0	0	1.3000E-02
	DECAY MODE - BETA-MINUS DAUGHTER ISOTOPE STABLE							
	4 SINGLE GAMMAS 403.000 62000 850.000 12000 2050.000 4000 2570.000 26000							
37-RB- 86	1.8700E 01 DAYS	9.1000E-01 BARNS	7.2150E 01 PC	37-RB- 85	1777	0	0	1.0000E-03
	DECAY MODE - BETA-MINUS DAUGHTER ISOTOPE STABLE							

100.00 PERCENT OF THE ISOMER DEEXCITES BY THE ISOMERIC TRANSITION TO THIS STATE

1 SINGLE GAMMA

1076.600	88000

37–RB– 86M 7.2222E–04 DAYS 1.0000E–01 BARNS 7.2150E 01 PC 37–RB– 85 0 0 0 1.0000E–01

1.0400E 00 MINUTES

DECAY MODE – ISOMERIC TRANSITION
DAUGHTER ISOTOPE DECAYS BY BETA-MINUS

1 SINGLE GAMMA

555.800	10000

37–RB– 88 1.2361E–02 DAYS 1.2000E–01 BARNS 2.7800E 01 PC 37–RB– 87 5210 0 0 1.0000E–02

1.7800E 01 MINUTES

DECAY MODE – BETA-MINUS
DAUGHTER ISOTOPE STABLE

11 SINGLE GAMMAS

898.000	14900
1390.000	1400
1836.100	23100
2118.600	1000
2677.600	2500
2760.000	100
3010.000	340
3240.000	340
3520.000	300
3680.000	80
4870.000	340

Isotope	Half-life	Cross-section	Abundance	Parent	Q^-	Q^+	Q Alpha	Factor
38–SR– 85	6.4000E 01 DAYS	1.3200E 00 BARNS	5.6000E–01 PC	38–SR– 84	0	1110	0	1.0000E–02

DECAY MODE – ELECTRON CAPTURE
DAUGHTER ISOTOPE STABLE

86.00 PERCENT OF THE ISOMER DEEXCITES BY THE ISOMERIC TRANSITION TO THIS STATE

3 SINGLE GAMMAS

360.000	0
513.998	10000
880.000	1

Isotope	Half-life	Cross-section	Abundance	Parent	Q^-	Q^+	Q Alpha	Factor
38–SR– 85M	4.8611E–02 DAYS 1.1667E 00 HOURS	6.0000E–01 BARNS	5.6000E–01 PC	38–SR– 84	0	1567	0	1.0000E–02

DECAY MODE – ELECTRON CAPTURE + ISOMERIC TRANSITION
DAUGHTER ISOTOPE DECAYS BY ONE OR BOTH OF BETA-PLUS AND E.C.

4 SINGLE GAMMAS

7.000	0
151.280	14000
231.690	85000
238.650	4000

Isotope	Half-life	Cross-section	Abundance	Parent	Q^-	Q^+	Q Alpha	Factor
38–SR– 87M	1.1667E–01 DAYS 2.8000E 00 HOURS	8.0000E–01 BARNS	9.9600E 00 PC	38–SR– 88	0	388	0	7.9000E–02

DECAY MODE – BETA-PLUS + ELECTRON CAPTURE
DAUGHTER ISOTOPE STABLE

1 SINGLE GAMMA

388.400	10000

38–SR– 89	5.2000E 01 DAYS	5.0000E–03 BARNS	8.2560E 01 PC	38–SR– 88	1463	0	0	9.0000E–06	
	DECAY MODE – BETA-MINUS DAUGHTER ISOTOPE STABLE								
	1 SINGLE GAMMA								
		910.000	10000						
38–SR– 91	4.0292E–01 DAYS	0 BARNS	0 PC	0– – 0	2670	0	0	3.0000E–02	
	9.6700E 00 HOURS								
	DECAY MODE – BETA-MINUS DAUGHTER ISOTOPE DECAYS BY BETA-MINUS								
	18 SINGLE GAMMAS								
		118.310	21						
		261.000	125						
		272.300	29						
		274.290	300						
		555.570	9470						
		620.130	510						
		631.290	175						
		652.910	3690						
		749.840	6970						
		761.290	208						
		925.830	1220						
		1024.290	10000						
		1054.700	50						
		1281.090	275						
		1413.580	339						
		1473.830	47						
		1546.530	13						
		1723.630	40						
38–SR– 92	1.0833E–01 DAYS	0 BARNS	0 PC	0– – 0	1915	0	0	9.0000E–02	
	2.6000E 00 HOURS								

Isotope	Half-life	Cross-section	Abundance	Parent	Q^-	Q^+	Q Alpha	Factor
38- SR- 92	DECAY MODE - BETA-MINUS DAUGHTER ISOTOPE DECAYS BY BETA-MINUS							
	4 SINGLE GAMMAS							
	241.530	336						
	430.450	464						
	953.320	430						
	1384.000	10000						
39- Y- 88	1.0660E 02 DAYS	0 BARNS	0 PC	0- - 0	0	3621	0	1.0000E-01
	DECAY MODE - BETA-PLUS + ELECTRON CAPTURE DAUGHTER ISOTOPE STABLE							
	3 SINGLE GAMMAS							
	898.000	9200						
	1836.075	10000						
	2734.070	100						
39- Y- 90	2.6708E 00 DAYS 6.4100E 01 HOURS	1.2600E 00 BARNS	1.0000E 02 PC	39- Y- 89	2270	0	0	1.7000E-05
	DECAY MODE - BETA-MINUS DAUGHTER ISOTOPE STABLE							
	1 SINGLE GAMMA							
	1734.000	10000						
39- Y- 90M	1.2917E-01 DAYS 3.1000E 00 HOURS	1.0000E-03 BARNS	1.0000E 02 PC	39- Y- 89	0	0	0	1.0000E-02
	DECAY MODE - BETA-MINUS + ISOMERIC TRANSITION DAUGHTER ISOTOPE DECAYS BY BETA-MINUS							

2 SINGLE GAMMAS

202.400	97000
479.300	92800

39- Y- 91 5.8800E 01 DAYS 0 BARNS 0 PC 0- - 0 1540 0 0 3.0000E-04

DECAY MODE - BETA-MINUS
DAUGHTER ISOTOPE STABLE

1 SINGLE GAMMA

1208.000	10000

39- Y- 91M 3.4722E-02 DAYS 0 BARNS 0 PC 0- - 0 0 0 0 0

5.0000E 01 MINUTES

DECAY MODE - ISOMERIC TRANSITION
DAUGHTER ISOTOPE DECAYS BY BETA-MINUS

1 SINGLE GAMMA

555.590	1000

39- Y- 92 1.4708E-01 DAYS 0 BARNS 0 PC 0- - 0 3600 0 0 1.4000E-02

3.5300E 00 HOURS

DECAY MODE - BETA-MINUS
DAUGHTER ISOTOPE STABLE

12 SINGLE GAMMAS

447.990	1820
492.170	360
560.810	1850
844.120	910
912.660	480
934.440	10000
972.350	60

Isotope	Half-life	Cross-section	Abundance	Parent	Q^-	Q^+	Q Alpha	Factor
39- Y- 92		1132.290 150						
		1405.440 3230						
		1848.070 210						
		1885.900 20						
		2066.000 0						
39- Y- 93	4.2500E-01 DAYS	0 BARNS	0 PC	0- - 0	2890	0	0	7.8000E-03
	1.0200E 01 HOURS							
	DECAY MODE - BETA-MINUS							
	DAUGHTER ISOTOPE DECAYS BY BETA-MINUS							
	18 SINGLE GAMMAS							
		266.750 10000						
		428.310 10						
		478.150 20						
		658.210 180						
		680.270 970						
		714.420 30						
		743.510 190						
		947.120 2960						
		1158.730 40						
		1182.500 50						
		1203.280 180						
		1425.390 360						
		1470.040 100						
		1827.150 140						
		1917.710 2230						
		2184.200 140						
		2190.800 260						
		2472.500 20						

40-ZR- 89	3.2667E 00 DAYS	0 BARNS	0 PC	0-	- 0	0	2834	0	1.0000E-02

DECAY MODE - BETA-PLUS + ELECTRON CAPTURE
DAUGHTER ISOTOPE STABLE

3 SINGLE GAMMAS

909.070	99000
1713.300	970
1621.400	120

40-ZR- 89M	2.9028E-03 DAYS	0 BARNS	0 PC	0-	- 0	0	3426	0	1.0000E-02
	4.1800E 00 MINUTES								

DECAY MODE - ELECTRON CAPTURE + ISOMERIC TRANSITION
DAUGHTER ISOTOPE DECAYS BY ONE OR BOTH OF BETA-PLUS AND E.C.

2 SINGLE GAMMAS

588.000	91500
1506.000	7300

40-ZR- 93	5.4750E 08 DAYS	2.5000E-01 BARNS	1.7110E 01 PC	40-ZR- 92		63	0	0	9.5000E-02
	1.5000E 06 YEARS								

DECAY MODE - BETA-MINUS
DAUGHTER ISOTOPE STABLE

1 SINGLE GAMMA

30.000	10000

40-ZR- 95	6.5500E 01 DAYS	7.5000E-02 BARNS	1.7400E 01 PC	40-ZR- 94		1120	0	0	9.8000E-03

DECAY MODE - BETA-MINUS
DAUGHTER ISOTOPE DECAYS BY BETA-MINUS

Isotope	Half-life	Cross-section	Abundance	Parent	Q^-	Q^+	Q Alpha	Factor
40-ZR- 95	3 SINGLE GAMMAS							
		235.700 0						
		724.240 44000						
		756.870 56000						
40-ZR- 97	7.0833E-01 DAYS	5.0000E-02 BARNS	2.8000E 00 PC	40-ZR- 96	2660	0	0	1.0000E-02
	1.7000E 01 HOURS							
	DECAY MODE - BETA-MINUS							
	DAUGHTER ISOTOPE DECAYS BY BETA-MINUS							
	12 SINGLE GAMMAS							
		254.100 1600						
		355.600 3000						
		602.500 1700						
		703.800 1300						
		743.200 94200						
		971.500 0						
		1147.900 3100						
		1276.100 0						
		1362.700 2700						
		1712.600 0						
		1750.600 1300						
		1852.000 300						
41-NB- 92M	1.0140E 01 DAYS	0 BARNS	0 PC	0- -- 0	0	0	0	1.0000E-02
	DECAY MODE - BETA-PLUS + ELECTRON CAPTURE							
	DAUGHTER ISOTOPE STABLE							
	3 SINGLE GAMMAS							
		912.660 1800						
		934.440 99000						
		1848.070 800						

41–NB– 94	7.3000E 06 DAYS 2.0000E 04 YEARS	1.1500E 00 BARNS	1.0000E 02 PC	41–NB– 93	2070	0	0	1.0000E–01

DECAY MODE – BETA-MINUS
DAUGHTER ISOTOPE STABLE
99.00 PERCENT OF THE ISOMER DEEXCITES BY THE ISOMERIC TRANSITION TO THIS STATE
2 SINGLE GAMMAS

702.590	10000
871.160	10000

41–NB– 94M	4.5833E–03 DAYS 6.6000E 00 MINUTES	1.0000E 00 BARNS	1.0000E 02 PC	41–NB– 93	2112	0	0	1.0000E–04

DECAY MODE – BETA-MINUS + ISOMERIC TRANSITION
DAUGHTER ISOTOPE DECAYS BY BETA-MINUS
3 SINGLE GAMMAS

41.500	0
703.000	200
872.000	20000

41–NB– 95	3.5150E 01 DAYS	0 BARNS	0 PC	0– – 0	1120	0	0	1.0000E–01

DECAY MODE – BETA-MINUS
DAUGHTER ISOTOPE STABLE
1 SINGLE GAMMA

765.800	10000

41–NB– 95M	3.7500E 00 DAYS	0 BARNS	0 PC	0– – 0	0	0	0	1.0000E–01

DECAY MODE – ISOMERIC TRANSITION
DAUGHTER ISOTOPE DECAYS BY BETA-MINUS
1 SINGLE GAMMA

235.700	10000

Isotope	Half-life	Cross-section	Abundance	Parent	Q^-	Q^+	Q Alpha	Factor
41–NB– 97	5.1389E–02 DAYS 1.2333E 00 HOURS	0 BARNS	0 PC	0– – 0	1930	0	0	1.0000E–02
	DECAY MODE – BETA-MINUS DAUGHTER ISOTOPE STABLE							
	4 SINGLE GAMMAS							
	658.000	98000						
	743.200	2000						
	1021.660	0						
	1148.000	0						
41–NB– 97M	6.9444E–04 DAYS 1.0000E 00 MINUTES	0 BARNS	0 PC	0– – 0	0	0	0	1.0000E–02
	DECAY MODE – ISOMERIC TRANSITION DAUGHTER ISOTOPE DECAYS BY BETA-MINUS							
	1 SINGLE GAMMA							
	743.300	98000						
42–MO– 93	1.1315E 06 DAYS 3.1000E 03 YEARS	3.0000E–01 BARNS	1.5860E 01 PC	42–MO– 92	0	490	0	1.0000E–02
	DECAY MODE – ELECTRON CAPTURE DAUGHTER ISOTOPE STABLE							
	1 SINGLE GAMMA							
	30.400	0						
42–MO– 93M	2.8750E–01 DAYS 6.9000E 00 HOURS	6.0000E–03 BARNS	1.5860E 01 PC	42–MO– 92	0	0	0	1.0000E–02

DECAY MODE - ISOMERIC TRANSITION
DAUGHTER ISOTOPE DECAYS BY ONE OR BOTH OF BETA-PLUS AND E.C.

3 SINGLE GAMMAS

264.000	6100
685.000	9700
1479.000	10000

42-MO- 99	2.7792E 00 DAYS	5.1000E-01 BARNS	2.3780E 01 PC	42-MO- 98	1370	0	0	1.0000E-02
	6.6700E 01 HOURS							

DECAY MODE - BETA-MINUS
DAUGHTER ISOTOPE DECAYS BY BETA-MINUS

10 SINGLE GAMMAS

40.600	1000
140.300	88700
142.000	3
180.900	7000
366.300	1800
410.000	150
620.000	7
739.300	15000
777.600	4000
940.000	140

42-MO-101	1.0417E-02 DAYS	2.0000E-01 BARNS	9.6300E 00 PC	42-MO-100	2820	0	0	1.0000E-02
	1.5000E 01 MINUTES							

DECAY MODE - BETA-MINUS
DAUGHTER ISOTOPE DECAYS BY BETA-MINUS

21 SINGLE GAMMAS

80.000	3000
191.000	25000

Isotope	Half-life	Cross-section	Abundance	Parent	Q^-	Q^+	Q Alpha	Factor
42–MO–101		193.000 2000						
		300.000 7000						
		400.000 2000						
		506.000 15000						
		590.800 21000						
		695.500 11000						
		700.000 1000						
		840.000 1000						
		890.000 15000						
		950.000 2000						
		1012.400 25000						
		1140.000 1000						
		1180.000 11000						
		1280.000 2000						
		1380.000 9000						
		1460.000 1000						
		1532.700 11000						
		1660.000 3000						
		2080.000 16000						
43–TC– 97	9.4900E 08 DAYS	0 BARNS	0 PC	0– – 0	0	100	0	0
	2.6000E 06 YEARS							
	DECAY MODE – ELECTRON CAPTURE DAUGHTER ISOTOPE STABLE							
43–TC– 99	7.6650E 07 DAYS	0 BARNS	0 PC	0– – 0	292	0	0	0
	2.1000E 05 YEARS							
	DECAY MODE – BETA-MINUS DAUGHTER ISOTOPE STABLE							

43-TC- 99M	2.5000E-01 DAYS 6.0000E 00 HOURS	0 BARNS	0 PC	0-	- 0	0	0	0	0
	DECAY MODE - ISOMERIC TRANSITION DAUGHTER ISOTOPE DECAYS BY BETA-MINUS								
	1 SINGLE GAMMA 142.700 0								
43-TC-101	9.7222E-03 DAYS 1.4000E 01 MINUTES	0 BARNS	0 PC	0-	- 0	1630	0	0	9.0000E-02
	DECAY MODE - BETA-MINUS DAUGHTER ISOTOPE STABLE								
	13 SINGLE GAMMAS 127.300 260 130.000 80 183.000 40 186.000 230 235.000 80 306.800 10000 385.000 180 410.000 40 544.900 800 626.600 100 720.000 120 846.000 36 939.000 25								
44-RU- 97	2.9000E 00 DAYS 6.9600E 01 HOURS	2.1000E-01 BARNS	5.7000E 00 PC	44-RU- 96		0	900	0	1.0000E-02
	DECAY MODE - ELECTRON CAPTURE DAUGHTER ISOTOPE DECAYS BY ONE OR BOTH OF BETA-PLUS AND E.C.								

Isotope	Half-life	Cross-section	Abundance	Parent	Q^-	Q^+	Q Alpha	Factor
44-RU- 97	4 SINGLE GAMMAS							
		109.000 1000						
		215.800 91000						
		325.100 8000						
		570.000 0						
44-RU-103	3.9600E 01 DAYS	1.2300E 00 BARNS	3.1610E 01 PC	44-RU-102	750	0	0	9.7000E-03
	DECAY MODE - BETA-MINUS DAUGHTER ISOTOPE STABLE							
	9 SINGLE GAMMAS							
		39.550 1100						
		53.220 500						
		295.000 700						
		323.000 0						
		362.000 300						
		443.850 500						
		497.880 91200						
		556.850 900						
		609.890 6300						
44-RU-105	1.8750E-01 DAYS 4.5000E 00 HOURS	4.7000E-01 BARNS	1.8580E 01 PC	44-RU-104	1871	0	0	1.0000E-02
	DECAY MODE - BETA-MINUS DAUGHTER ISOTOPE DECAYS BY BETA-MINUS							
	10 SINGLE GAMMAS							
		130.000 6000						
		210.000 2000						
		263.200 9000						
		317.100 13000						

		400.000	3000						
		469.600	19000						
		676.000	6000						
		724.300	44000						
		876.000	3000						
		969.900	2000						
45-RH-104	4.8611E-04 DAYS	1.4000E 02 BARNS		1.0000E 02 PC	45-RH-103	2440	0	0	2.1000E-04
	4.2000E 01 SECONDS								
	DECAY MODE – BETA-MINUS								
	DAUGHTER ISOTOPE STABLE								
	2 SINGLE GAMMAS								
		555.800	94000						
		1240.000	6000						
45-RH-104M	3.0556E-03 DAYS	1.1000E 01 BARNS		1.0000E 02 PC	45-RH-103	2568	0	0	1.0000E-02
	4.4000E 00 MINUTES								
	DECAY MODE – BETA-MINUS + ISOMERIC TRANSITION								
	DAUGHTER ISOTOPE DECAYS BY ONE OR BOTH OF BETA-PLUS AND E.C.								
	10 SINGLE GAMMAS								
		51.400	47000						
		77.600	2500						
		97.200	2500						
		555.800	200						
		745.000	0						
		780.000	0						
		930.000	0						
		1250.000	0						
		1340.000	0						
		1810.000	0						

Isotope	Half-life	Cross-section	Abundance	Parent	Q^-	Q^+	Q Alpha	Factor
45-RH-105	1.5000E 00 DAYS 3.6000E 01 HOURS	0 BARNS	0 PC	0- - 0	565	0	0	1.0000E-02
	DECAY MODE - BETA-MINUS DAUGHTER ISOTOPE STABLE							
	4 SINGLE GAMMAS							
		280.000 0						
		306.200 5000						
		319.100 20000						
		443.000 0						
45-RH-105M	5.2083E-04 DAYS 4.5000E 01 SECONDS	0 BARNS	0 PC	0- - 0	0	0	0	1.0000E-02
	DECAY MODE - ISOMERIC TRANSITION DAUGHTER ISOTOPE DECAYS BY BETA-MINUS							
	1 SINGLE GAMMA							
		130.000 15500						
45-RH-106	3.4722E-04 DAYS 3.0000E 01 SECONDS	0 BARNS	0 PC	0- - 0	0	0	0	1.8000E-02
	DECAY MODE - BETA-MINUS DAUGHTER ISOTOPE STABLE							
	14 SINGLE GAMMAS							
		511.900 10000						
		616.300 4500						
		622.100 600						
		710.000 20						
		873.800 180						

		1050.400	680						
		1130.000	230						
		1490.000	16						
		1550.000	64						
		1770.000	19						
		1950.000	8						
		2090.000	13						
		2360.000	17						
		2640.000	3						
46-PD-103	1.7000E 01 DAYS	4.8000E 00 BARNS		9.6800E-01 PC	46-PD-102	0	560	0	1.0000E-05
	DECAY MODE - ELECTRON CAPTURE DAUGHTER ISOTOPE STABLE								
	6 SINGLE GAMMAS								
		52.000	0						
		65.000	1000						
		299.000	11000						
		324.000	4000						
		362.000	74000						
		498.000	10000						
46-PD-107	2.5550E 09 DAYS 7.0000E 06 YEARS	2.9200E-01 BARNS		2.7300E 01 PC	46-PD-106	35	0	0	0
	DECAY MODE - BETA-MINUS DAUGHTER ISOTOPE STABLE								
46-PD-109	5.6667E-01 DAYS 1.3600E 01 HOURS	1.2260E 01 BARNS		2.6710E 01 PC	46-PD-108	1113	0	0	1.0000E-03
	DECAY MODE - BETA-MINUS DAUGHTER ISOTOPE STABLE								

Isotope	Half-life	Cross-section	Abundance	Parent	Q^-	Q^+	Q Alpha	Factor
46-PD-109	100.00 PERCENT OF THE ISOMER DEEXCITES BY THE ISOMERIC TRANSITION TO THIS STATE							
	20 SINGLE GAMMAS							
		44.800	36					
		88.036	89000					
		103.600	22					
		134.700	32					
		145.900	27					
		311.500	0					
		390.900	25					
		413.500	0					
		415.200	0					
		424.700	18					
		448.200	26					
		551.300	15					
		557.800	62					
		602.400	215					
		636.100	270					
		647.300	650					
		701.800	92					
		707.300	45					
		736.700	50					
		781.800	330					
46-PD-109M	3.2639E-03 DAYS	2.0000E-01 BARNS	2.6710E 01 PC	46-PD-108	0	0	0	6.6000E-02
	4.7000E 00 MINUTES							
	DECAY MODE - ISOMERIC TRANSITION DAUGHTER ISOTOPE DECAYS BY BETA-MINUS							
	1 SINGLE GAMMA							
		188.900	10000					

46-PD-111	1.5278E-02 DAYS 2.2000E 01 MINUTES	2.0000E-01 BARNS	1.1800E 01 PC	46-PD-110	2190	0	0	0

DECAY MODE – BETA-MINUS
DAUGHTER ISOTOPE DECAYS BY BETA-MINUS
10 SINGLE GAMMAS

70.100	0
377.000	19000
580.000	24000
620.000	24000
810.000	4000
1380.000	15000
1450.000	15000
149.000	0
247.000	1000
342.000	6000

46-PD-111M	2.2917E-01 DAYS 5.5000E 00 HOURS	3.7000E-02 BARNS	1.1800E 01 PC	46-PD-110	2360	0	0	0

DECAY MODE – BETA-MINUS + ISOMERIC TRANSITION
DAUGHTER ISOTOPE STABLE
12 SINGLE GAMMAS

170.000	0
1690.000	0
70.100	0
377.000	0
580.000	0
620.000	0
810.000	0
1380.000	0
1450.000	0
149.000	0
247.000	0
342.000	0

Isotope	Half-life	Cross-section	Abundance	Parent	Q^-	Q^+	Q Alpha	Factor
47–AG–107M	5.1273E–04 DAYS 4.4300E 01 SECONDS	0 BARNS	0 PC	0– – 0	0	0	0	1.0000E–03
	DECAY MODE – ISOMERIC TRANSITION DAUGHTER ISOTOPE STABLE							
	1 SINGLE GAMMA							
	93.200	48300						
47–AG–108	1.5972E–03 DAYS 2.3000E 00 MINUTES	3.5000E 01 BARNS	5.1350E 01 PC	47–AG–107	1650	1710	0	1.0000E–03
	DECAY MODE – BETA-PLUS + BETA-MINUS + ELECTRON CAPTURE DAUGHTER ISOTOPE STABLE							
	6 SINGLE GAMMAS							
	433.800	4500						
	510.000	0						
	614.290	2600						
	633.200	17000						
	841.000	200						
	1010.000	0						
47–AG–108M	1.8250E 03 DAYS 5.0000E 00 YEARS	0 BARNS	5.1350E 01 PC	47–AG–107	0	1822	0	9.0000E–02
	DECAY MODE – ELECTRON CAPTURE + ISOMERIC TRANSITION DAUGHTER ISOTOPE DECAYS BY BETA-MINUS							
	5 SINGLE GAMMAS							
	30.200	0						
	79.490	600						
	433.990	10000						
	614.290	10000						
	722.810	10000						

47–AG–109M	4.6296E–04 DAYS	0 BARNS	0 PC	0– – 0	0	0	0	1.0000E–03
	4.0000E 01 SECONDS							
	DECAY MODE – ISOMERIC TRANSITION DAUGHTER ISOTOPE STABLE							
	1 SINGLE GAMMA							
	88.036	39800						
47–AG–110	2.7778E–04 DAYS	8.9000E 01 BARNS	4.8650E 01 PC	47–AG–109	2869	0	0	1.0000E–02
	2.4000E 01 SECONDS							
	DECAY MODE – BETA-MINUS DAUGHTER ISOTOPE STABLE							
	3 SINGLE GAMMAS							
	657.600	12000						
	817.900	0						
	1475.900	20						
47–AG–110M	2.5300E 02 DAYS	3.2000E 00 BARNS	4.8650E 01 PC	47–AG–109	3009	0	0	9.6000E–02
	DECAY MODE – BETA-MINUS + ISOMERIC TRANSITION DAUGHTER ISOTOPE STABLE							
	16 SINGLE GAMMAS							
	116.410	0						
	446.200	0						
	620.100	0						
	657.600	10000						
	677.500	1000						
	686.800	700						
	706.600	1000						
	744.200	0						
	763.800	2400						
	817.900	800						

Isotope	Half-life	Cross-section		Abundance	Parent	Q^-	Q^+	Q Alpha	Factor
47-AG-110M		884.500	7400						
		937.300	3300						
		1384.300	2200						
		1475.900	400						
		1505.200	1100						
		1562.500	120						
47-AG-111	7.5000E 00 DAYS	0 BARNS		0 PC	0- - 0	1050	0	0	1.0000E-03
	DECAY MODE - BETA-MINUS DAUGHTER ISOTOPE STABLE								
	2 SINGLE GAMMAS								
		245.400	9000						
		341.900	58000						
48-CD-107	2.7917E-01 DAYS 6.7000E 00 HOURS	1.0000E 00 BARNS		1.2200E 00 PC	48-CD-106	0	1440	0	4.8000E-03
	DECAY MODE - BETA-PLUS + ELECTRON CAPTURE DAUGHTER ISOTOPE STABLE								
	3 SINGLE GAMMAS								
		93.000	10000						
		796.000	200						
		829.000	400						
48-CD-109	4.5000E 02 DAYS 1.2329E 00 YEARS	1.5000E 00 BARNS		8.8000E-01 PC	48-CD-108	0	158	0	1.0000E-03
	DECAY MODE - ELECTRON CAPTURE DAUGHTER ISOTOPE STABLE								
	1 SINGLE GAMMA								
		88.000	88000						

48-CD 111M	3.3750E-02 DAYS	1.0000E-01 BARNS	1.2390E 01 PC	48-CD-110	0	0	0	1.0000E-02
	4.8600E 01 MINUTES							
	DECAY MODE - ISOMERIC TRANSITION DAUGHTER ISOTOPE STABLE							
	2 SINGLE GAMMAS							
		150.800	30000					
		245.400	94000					
48-CD-113M	5.1100E 03 DAYS	3.0000E 03 BARNS	2.4070E 01 PC	48-CD-112	575	0	0	1.0000E-04
	1.4000E 01 YEARS							
	DECAY MODE - BETA-MINUS + ISOMERIC TRANSITION DAUGHTER ISOTOPE STABLE							
	1 SINGLE GAMMA							
		265.000	10000					
48-CD-115	2.2500E 00 DAYS	3.0000E-01 BARNS	2.8860E 01 PC	48-CD-114	1450	0	0	1.0000E-02
	5.4000E 01 HOURS							
	DECAY MODE - BETA-MINUS DAUGHTER ISOTOPE DECAYS BY BETA-MINUS							
	5 SINGLE GAMMAS							
		230.000	500					
		263.000	1900					
		335.000	52800					
		492.500	10100					
		527.700	26400					

Isotope	Half-life	Cross-section	Abundance	Parent	Q^-	Q^+	Q Alpha	Factor
48-CD-115M	4.300E 01 DAYS	1.4000E-01 BARNS	2.8860E 01 PC	48-CD-114	1630	0	0	1.0000E-03
	DECAY MODE - BETA-MINUS DAUGHTER ISOTOPE DECAYS BY BETA-MINUS							
	3 SINGLE GAMMAS							
		484.900 4000						
		934.100 20000						
		1289.900 9000						
48-CD-117	1.0417E-01 DAYS	5.0000E-02 BARNS	7.5800E 00 PC	48-CD-116	2600	0	0	1.0000E-02
	2.5000E 00 HOURS							
	DECAY MODE - BETA-MINUS DAUGHTER ISOTOPE DECAYS BY BETA-MINUS							
	11 SINGLE GAMMAS							
		89.000 7000						
		273.000 3100						
		314.000 16000						
		345.000 18000						
		434.000 13000						
		832.000 4000						
		880.000 3000						
		950.000 4000						
		1050.000 5000						
		1303.000 19000						
		1577.000 17000						
48-CD-117M	1.4167E-01 DAYS	0 BARNS	7.5800E 00 PC	48-CD-116	0	0	0	3.6000E-01
	3.4000E 00 HOURS							

DECAY MODE – BETA-MINUS
DAUGHTER ISOTOPE DECAYS BY BETA-MINUS

44 SINGLE GAMMAS

89.000	0
161.000	0
222.000	0
273.000	0
293.000	0
314.000	0
345.000	0
366.000	60
434.000	0
462.000	0
565.000	0
631.000	20
702.000	30
715.000	50
748.000	30
762.000	0
832.000	0
862.000	30
880.000	0
931.000	20
1029.000	40
1052.000	0
1065.000	110
1117.000	50
1165.000	0
1233.000	80
1248.000	30
1260.000	20
1338.000	90
1371.000	0
1408.000	90
1433.000	120

Isotope	Half-life	Cross-section		Abundance	Parent	Q^-	Q^+	Q Alpha	Factor
48-CD-117M		1562.000	70						
		1652.000	0						
		1659.000	0						
		1682.000	30						
		1723.000	90						
		1939.000	0						
		1998.000	170						
		2095.000	20						
		2311.000	0						
		2319.000	40						
		2394.000	0						
		2407.000	0						