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INTERNATIONAL NUCLEAR DATA COMMITTEE

Proposed Recommended List
of Transactinium Isotope Decay Data
Part I. Half-lives (December 1980 Edition)

This compilation supersedes the September 1979 Edition

A. Lorenz, editor

Compiled by Members of the IAEA
Coordinated Research Programme on the
Measurement and Evaluation of Transactinium
Isotope Decay Data

December 1980

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Introduction

The objective of the IAEA Coordinated Research Programme (CRP) on the Measurement and Evaluation of Transactinium Isotope Nuclear Decay Data, is to arrive at a consistent set of transactinium isotope decay data and their uncertainties (including half-lives, branching fractions and gamma-ray and alpha emission spectra) which would satisfy the requirements identified by the community of data users.

Since the beginning of their activities in 1978 members of this CRP have reviewed the status of heavy isotope decay data, and have contributed to the compilation of the "Proposed Recommended List" presented in this report.

In its present form, the enclosed list should be regarded as containing tentatively proposed values. The group recognizes that considerable expertise in the area of half-life measurement and evaluation exists within research groups not directly involved in the preparation of this list. Consequently, this group wishes to elicit as wide a range of comments and criticism as possible on this list of proposed values.

To avoid misunderstanding regarding the purpose of these tabulations the members of this CRP have prepared the following statement:

"It appears that some confusion has arisen over the purpose of the recommended list of half lives proposed after the last Coordination Research Programme meeting on Measurement and Evaluation of Transactinium Isotope Decay Data. The listing has been seen by some people as a definitive evaluation which is being recommended for international acceptance. The members of this group would like to make it clear that the intention of producing this list was as a current statement of the status of half life values for the transactinium nuclides. These values together with the uncertainties associated with them are then available to other experts such as evaluators and measurers of data, who are not represented on the CRP. From this and subsequent listings and the comments received, the CRP hopes to be able to assess and monitor the progress being made in the field of transactinium isotope decay data. These listings should eventually serve as the initial part of an international reference list of transactinium isotope nuclear decay data".

Further reference to the activities of this CRP can be found in the Summary Report of their June 1980 meeting, INDC(NDS)-118/NE.

List of Half-Lives - December 1980 Edition

The decay data listed in this tabulation are the result of a critical appraisal of the current status of the transactinium isotope half-lives and branching fractions by members of the IAEA Coordinated Research Programme on Measurement and Evaluation of Transactinium Isotope Decay Data. Members of this Coordinated Research Programme and those who participated in the critical review of the data (referred to below as the "Group") are listed in Appendix 1.

The data compiled in this list have been drawn from the following existing decay data files:

- ENSDF, the Evaluated Nuclear Structure and Decay Data File. Compiled by the Nuclear Data Project at Oak Ridge,
- the Actinide data file of the Idaho National Engineering Laboratory (INEL) which serves as the source file for the decay data part of the ENDF/B compilation,
- the UK Chemical Nuclear Data Committee Heavy Element Decay Data File, compiled at the AEE Winfrith laboratory.

Whenever warranted, the data have been supplemented or superseded by the latest known measured and/or evaluated values.

At their meeting in June 1980, the Group reviewed the "Proposed Recommended List of Transactinium Isotope Decay Data. Part I. Half-lives (September 1979 Edition)", published in INDC(NDS)-108/N, in the light of new measurements which have been completed since the May 1979 meeting, and decided to enlarge the initial 1979 half-lives list to include the "Heavy Element Decay Data Table" presented in Table I of the Summary Report of the May 1979 CRP meeting (INDC(NDS)-105) and an additional list of heavy element decay data taken from the UK Heavy Element Decay Data File compiled at the AEE Winfrith laboratory.

In reviewing the measurements which have been completed since the last meeting (May 1979), the group made the following changes in the recommended list of half-lives:

- Th-230 Adopted the half-life value of $(7.54 \pm .03) \times 10^4$ y measured by Meadows et al. (Phys. Rev. C 22 750 (1980)) to replace the earlier recommended value of $(7.7 \pm 0.3) \times 10^4$ y, yielding an improved accuracy of 0.4 %. In addition to the new measurement by Meadows et al., the U/Th Workshop, held at USGS, Denver, Colorado, 19 August 1978, did not accept the previously adopted value of 7.7×10^4 y on the grounds that studies of world ocean sedimentation require a value of 7.5×10^4 y in order to remain consistent with established geochronological methods.

- U -232 Adopted a new half-life value of $(7.0 \pm 0.1) \times 10^1$ y on the basis of a new measurement by Aggarwal et al. at BARC, Trombay (Phys. Rev. C 20 (1979) 1533) of 69.9 ± 0.39 years. The choice of the lower Aggarwal value was supported by the fact that two higher values obtained by $2\pi\alpha$ counting were cancelled since it was shown that $2\pi\alpha$ counting, used for other nuclides (e.g. Pu 239), was shown to yield $T_{1/2}$ values that were too high.
- Pu-240 Adopted a new spontaneous fission half-life value of $(1.2 \pm 0.1) \times 10^4$ y on the basis of new measurement by Budtz-Jorgensen and Knitter (Proceedings of a Meeting on Nuclear Data of Pu and Am Isotopes for Reactor applications, R.E. Chrien Ed., Brookhaven 1979). The adoption of this value was also supported by a private communication transmitted from Dr. Sowerby (Harwell) at the 1980 Nuclear Transmutation of Actinides Meeting at Ispra, that the previously adopted value was too high.
- Am-242m Adopted the new total half-life value of $(1.41 \pm 0.02) \times 10^2$ y measured by A.G. Zelenkov et al. (Atomn. Energiya 47 (1979) 404), and the α -decay branching fraction as $(4.5 \pm 0.2) \times 10^{-3}$.
- Cm-243 Adopted the (Nuclear Data Sheets 19, No. 1 (1976) 128) half-life value of (28.5 ± 0.2) y.
- Cm-245 Adopted the (Nuclear Data Sheets 19, No. 1 (1976) 165) half-life value of $(8.5 \pm 0.1) \times 10^{-3}$ y.
- Es-253 Adopted a new half-life value of (20.4 ± 0.1) d as a mean between the earlier proposed value of (20.47 ± 0.02) d and a newly measured USSR value of (20.29 ± 0.09) d at a 95 % confidence level (Private Communication at the May 1980 Meeting, see Appendix 9 of Summary Report).

The group has taken note of a number of newly reported values for the half-life of Pu-241. These are almost exclusively lower than the value recommended by this group. The uncertainties claimed for these measurements are sufficiently small to indicate that these are not reconcilable with some of the previous measurements. No adequate reasons can be found for the rejection of any of the values published in the last ten years or for the discrepancies that exist.

This group recommends that no change be made at this time (i.e. June 1980) to the presently listed value of (14.7 ± 0.4) y for this quantity. When the measurements recently completed and those in progress are published, it is hoped that a value with the required accuracy can be recommended.

Table Content

<u>Decay mode:</u>	A	Alpha decay	IT	Isomeric transition
	B-	Beta decay	SF	Spontaneous fission
	EC	Electron capture	T	Total half-life (calculated from partial half lives)

<u>Units:</u>	MS	millisecond	H	hour
	S	second	D	day
	M	minute	Y	year (= 365.2422 days)

Half-life data: expressed in commonly accepted units

Half-life uncertainties:

In ascribing uncertainties to the recommended half-life values, the group adopted the following criteria:

- the total uncertainty be defined as "1 sigma random error plus 1/3 the linear sum of the systematic errors based on a statistical confidence level of 68.3 %", and that
- the total uncertainty be in no case lower than 0.1 %.

It must be noted that not all assigned uncertainties have an experimental basis.

Percent uncertainty: calculated quantity; number of significant figures provides visual check of data consistency.

Branching fractions: defined such that the total decay probability for all modes of decay does not exceed unity.

Reference: identification of data origin, given at end of table.

Compiler Reference: identification of compilation.

Comments: see end of Table.

NUCLIDE	DECAY* MODE	UNITS	HALF-LIFE			BRANCHING FRACTION			* REFERENCE	COMPILER REFERENCE	COMMENT		
			DATA	UNCERTAINTY	PER-CENT	DATA	UNCERTAINTY	PER-CENT					
80-HG-206	B- *	M	(8.15	+ 0.10	)	1.227 *			* NI7801	ALTD01		
81-TL-206	B- *	M	(4.20	+ 0.02	)	0.476 *			* NI7802	ALTD01		
81-TL-206M1	IT *	M	(3.8	+ 0.2	)	5.263 *			* NI7802	ALTD01		
81-TL-207	B- *	M	(4.77	+ 0.03	)	0.629 *			* NI7801	ALTD01		
81-TL-207M1	IT *	S	(1.33	+ 0.11	)	8.271 *			* NI7801	ALTD01		
81-TL-208	B- *	M	(3.053	+ 0.004	)	0.131 *			* NI7802	ALTD01		
81-TL-209	B- *	M	(2.20	+ 0.07	)	3.182 *			* NI7801	ALTD01		
81-TL-210	B- *	M	(1.30	+ 0.03	)	2.308 *			* NI7802	ALTD01		
82-PB-205	EC *	Y	(1.4	+ 0.1	)E+7	7.143 *			* NI7802	ALTD01		
82-PB-209	B- *	H	(3.253	+ 0.014	)	0.430 *			* NI7801	ALTD01		
82-PB-210	A *	Y	(1.01	+ 0.32)E+9	31.683 *	(2.2	+ 0.7)E-8	31.818 *	NI7802	ALTD01	A
82-PB-210	B- *	Y	(22.2	+ 0.2	)	0.901 *	1.0		* NI7802	ALTD01		
82-PB-211	B- *	M	(36.1	+ 0.2	)	0.554 *			* NI7801	ALTD01		
82-PB-212	B- *	H	(10.64	+ 0.01	)	0.094 *			* NI7802	ALTD01		
82-PB-214	B- *	M	(26.8	+ 0.9	)	3.358 *			* NI7801	ALTD01		
83-BI-210	A *	Y	(1.056	+ 0.081)E+4	7.670 *	(1.3	+ 0.1)E-6	7.692 *	NI7802	ALTD01	A
83-BI-210	B- *	D	(5.013	+ 0.005	)	0.100 *	1.0		* NI7802	ALTD01		
83-BI-210M1	A *	Y	(3.0	+ 0.2	)E+6	6.667 *			* NI7802	ALTD01		
83-BI-211	A *	M	(2.17	+ 0.04)	1.843 *	(0.99727	+ 0.00004)	0.004 *	NI7801	ALTD01	
83-BI-211	B- *	H	(13.25	+ 0.28)	2.113 *	(2.73	+ 0.03)E-3	1.099 *	NI7801	ALTD01	A
83-BI-212	T *	M	(60.60	+ 0.05	)	0.083 *			* NI7802	ALTD01	C	
83-BI-212	A *	M	(168.8	+ 0.5)	0.296 *	(0.359	+ 0.001)	0.279 *	NI7802	ALTD01	A
83-BI-212	B- *	M	(94.54	+ 0.17)	0.180 *	(0.641	+ 0.001)	0.156 *	NI7802	ALTD01	A
83-BI-212M1	T *	M	(25.	+ 1.0	)	4.000 *			* NI7802	ALTD01	C	
83-BI-212M1	A *	M	(26.9	+ 1.6)	5.948 *	(0.93	+ 0.04)	4.301 *	NI7802	ALTD01	A
83-BI-212M1	R- *	M	(357.	+ 204.)	57.143 *	(0.07	+ 0.04)	57.143 *	NI7802	ALTD01	A
83-BI-212M2	R- *	M	(9.	+ 1.	)	11.111 *			* NI7802	ALTD01		
83-BI-213	T *	M	(45.59	+ 0.06	)	0.132 *			* NI7802	ALTD01	C	
83-BI-213	A *	H	(35.18	+ 2.12)	6.026 *	(0.0216	+ 0.0013)	6.019 *	NI7802	ALTD01	A
83-BI-213	B- *	M	(46.60	+ 0.09)	0.193 *	(0.9784	+ 0.0013)	0.133 *	NI7802	ALTD01	A
83-BI-214	A *	D	(65.8	+ 3.4)	5.167 *	(2.1	+ 0.1)E-4	4.762 *	NI7802	ALTD01	A
83-BI-214	B- *	M	(19.9	+ 0.4)	2.010 *	(0.99979	+ 0.00001)	0.001 *	NI7802	ALTD01	

NUCLIDE	DECAY MODE	* UNITS	DATA	HALF-LIFE		PER-CENT	BRANCHING FRACTION			* REFERENCE	COMPILER REFERENCE	COMMENT	
				UNCERTAINTY			DATA	UNCERTAINTY	PER-CENT				
83-BI-215	B-	* M	(7.4	+ 0.6	)	8.108				* NI7801	ALTD01	
84-PO-209	A	* Y	(102.0	+ 5.0)	4.902	(0.9974	+ 0.0001)	0.010	* NI7802	ALTD01	
84-PO-209	EC	* Y	(392.3	+ 24.4)	6.220	(2.6	+ 0.1)E-3	3.846	* NI7802	ALTD01	A
84-PO-210	A	* D	(138.4	+ 0.2	)	0.145				* NI7802	ALTD01	
84-PO-211	A	* S	(0.516	+ 0.003	)	0.581				* NI7801	ALTD01	
84-PO-211M1	A	* S	(25.5	+ 0.3)	1.176	(0.998	+ 0.002)	0.200	* NI7801	ALTD01	
84-PO-212	A	* S	(3.00	+ 0.05	)E-7	1.667				* NI7802	ALTD01	
84-PO-212M1	A	* S	(45.1	+ 0.6)	1.330	(1.000	+ 0.015)	1.500	* NI7802	ALTD01	
84-PO-213	A	* S	(4.2	+ 0.8	)E-6	19.048				* NI7802	ALTD01	
84-PO-214	A	* MS	(0.165	+ 0.003	)	1.818				* NI7801	ALTD01	
84-PO-215	A	* MS	(1.78	+ 0.01	)	0.562	1.0			* NI7801	ALTD01	
84-PO-215	B-	* S	(445.	+ 445.)	100.000	(4.	+ 2.)E-6	50.000	* NI7801	ALTD01	A
84-PO-216	A	* S	(0.15	+ 0.01	)	6.667				* NI7801	ALTD01	
84-PO-218	A	* M	(3.05	+ 0.09)	2.951	(0.9998	+ 0.0001)	0.010	* NI7801	ALTD01	
84-PO-218	B-	* D	(10.6	+ 5.3)	50.000	(2.	+ 1.)E-4	50.000	* NI7801	ALTD01	A
85-AT-215	A	* MS	(0.1	+ 0.02	)	20.000				* NI7801	ALTD01	
85-AT-217	A	* S	(0.0323	+ 0.0004)	1.238	(0.99988	+ 0.00004)	0.004	* NI7802	ALTD01	
85-AT-217	B-	* S	(270.	+ 90.)	33.333	(1.2	+ 0.4)E-4	33.333	* NI7802	ALTD01	A
85-AT-218	A	* S	(1.6	+ 0.4)	25.000	(0.999	+ 0.001)	0.100	* NI7801	ALTD01	
85-AT-218	B-	* M	(26.7	+ 26.7)	100.000	(1.	+ 1.)E-3	100.000	* NI7801	ALTD01	A
85-AT-219	T	* M	(0.9	+ 0.1	)	11.111				* NI7801	ALTD01	
85-AT-219	A	* M	(0.928	+ 0.104)	11.207	(0.97	+ 0.01)	1.031	* NI7801	ALTD01	A
85-AT-219	B-	* M	(30.	+ 10.)	33.333	(0.03	+ 0.01)	33.333	* NI7801	ALTD01	A
86-RN-217	A	* S	(5.4	+ 0.5	)E-4	9.259				* NI7802	ALTD01	
86-RN-218	A	* MS	(35.0	+ 6.0	)	17.143				* NI7801	ALTD01	
86-RN-219	A	* S	(3.96	+ 0.05	)	1.263				* NI7801	ALTD01	
86-RN-220	A	* S	(55.6	+ 0.1	)	0.180				* NI7801	ALTD01	
86-RN-222	A	* D	(3.825	+ 0.004	)	0.105				* NI7801	ALTD01	
87-FR-221	A	* M	(4.9	+ 0.2	)	4.082				* NI7802	ALTD01	
87-FR-223	A	* D	(252.	+ 42.)	16.667	(6.	+ 1.)E-5	16.667	* NI7802	ALTD01	A
87-FR-223	B-	* M	(21.8	+ 0.4)	1.835	(0.99994	+ 0.00001)	0.001	* NI7802	ALTD01	

88-RA-223 PROPOSED RECOMMENDED TRANSACTINIUM ISOTOPE HALF-LIVES AND BRANCHING FRACTIONS

NUCLIDE	DECAY MODE	UNITS	DATA	HALF-LIFE		PER-CENT	BRANCHING FRACTION			REFERENCE	COMPILER REFERENCE	COMMENT	
				UNCERTAINTY			DATA	UNCERTAINTY	PER-CENT				
88-RA-223	A	D	(11.43	+- 0.02	)	0.175				* NI7801	ALTD01	
88-RA-224	A	D	(3.66	+- 0.04	)	1.093				* NI7801	ALTD01	
88-RA-225	B-	D	(14.8	+- 0.2	)	1.351				* NI7802	ALTD01	
88-RA-226	A	Y	(1.600	+- 0.007	)E+3	0.438				* NI7801	ALTD01	
88-RA-228	R-	Y	(5.75	+- 0.03	)	0.522				* NI7801	ALTD01	
89-AC-225	A	D	(10.0	+- 0.1	)	1.000				* NI7802	ALTD01	
89-AC-227	T	Y	(21.77	+- 0.03	)	0.138				* NI7802	ALTD01	C
89-AC-227	A	Y	(1578.	+- 11.)	0.697	(0.0138	+- 0.0001)	0.725	* NI7802	ALTD01	A
89-AC-227	B-	Y	(22.07	+- 0.03)	0.136	(0.9862	+- 0.0001)	0.010	* NI7802	ALTD01	A
89-AC-228	B-	H	(6.13	+- 0.09	)	1.468				* NI7801	ALTD01	
90-TH-227	A	D	(18.716	+- 0.020	)	0.107				* NI7802	ALTD01	
90-TH-228	A	Y	(1.913	+- 0.002	)	0.105				* L07901	ALTD01	
90-TH-229	A	Y	(7.34	+- 0.16	)E+3	2.180				* NI7802	ALTD01	
90-TH-230	A	Y	(7.54	+- 0.03	)E+4	0.398	1.0			* ME7901	ALTD01	
90-TH-230	SF	Y	(1.5	+- 1.5)E+17	100.000	(5.0	+- 5.0)E-13	100.000	* LE7801	ALTD01	B
90-TH-231	B-	H	(25.52	+- 0.03	)	0.118				* NI7801	ALTD01	
90-TH-232	A	Y	(1.405	+- 0.006	)E+10	0.427	1.0			* L07901	ALTD01	
90-TH-232	SF	Y	1.E+21				1.405E-11			* LE7801	ALTD01	B	
90-TH-233	R-	M	(22.3	+- 0.2	)	0.897				* NI7802	ALTD01	
90-TH-234	B-	D	(24.10	+- 0.03	)	0.124				* NI7801	ALTD01	
90-TH-235	B-	M	(6.9	+- 0.2	)	2.899				* NI7801	ALTD01	
91-PA-231	A	Y	(3.276	+- 0.011	)E+4	0.336	1.0			* L07901	ALTD01	
91-PA-231	SF	Y	1.1E+16				3.0E-12			* LE7801	ALTD01	B	
91-PA-232	B-	D	(1.31	+- 0.02	)	1.527				* L07901	ALTD01	
91-PA-232	EC	Y	(120.0	+- 40.0)	33.333	(3.	+- 1.)E-5	33.333	* NI7802	ALTD01	
91-PA-233	B-	D	(27.0	+- 0.1	)	0.370				* L07901	ALTD01	
91-PA-234	R-	H	(6.70	+- 0.05	)	0.746				* NI7802	ALTD01	
91-PA-234M1	H-	M	(1.17	+- 0.01)	0.855	(0.9987	+- 0.0002)	0.020	* NI7802	ALTD01	
91-PA-234M1	IT	H	(15.	+- 2.3)	15.333	(0.0013	+- 0.0002)	15.385	* NI7802	ALTD01	A
91-PA-235	R-	M	(24.2	+- 0.3)	1.240				* NI7801	ALTD01		

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PROPOSED RECOMMENDED TRANSACTINIUM ISOTOPE HALF-LIVES AND BRANCHING FRACTIONS

NUCLIDE	DECAY* MODE	* UNITS	DATA	HALF-LIFE		PER-CENT	BRANCHING FRACTION			* REFERENCE	COMPILER REFERENCE	COMMENT
				UNCERTAINTY			DATA	UNCERTAINTY	PER-CENT			
92-U -232	A *	Y	(70.0	+- 1.0	)	1.429 *	1.0			* AG7901	ALTD01	
92-U -232	SF *	Y	(78.	+- 60.	)E+12	76.923 *	(0.9	+- 0.7	)E-12	77.778 *	RE7801	ALTD01 A
92-U -233	A *	Y	(1.592	+- 0.002	)E+5	0.126 *	1.0			* L07901	ALTD01	
92-U -233	SF *	Y	(1.2	+- 0.3	)E+17	25.000 *	(1.3	+- 0.3	)E-12	23.077 *	RE7801	ALTD01 A
92-U -234	A *	Y	(2.446	+- 0.007	)E+5	0.286 *	1.0			* L07901	ALTD01	
92-U -234	SF *	Y	(2.0	+- 1.0	)E+16	50.000 *	(1.2	+- 0.6	)E-11	50.000 *	RE7801	ALTD01 A
92-U -235	A *	Y	(7.038	+- 0.007	)E+8	0.099 *	1.0			* L07901	ALTD01	
92-U -235	SF *	Y	(3.5	+- 0.9	)E+17	25.714 *	(2.	+- 0.5	)E-9	25.000 *	LE7801	ALTD01 B
92-U -235M1	IT *	M	(26.	+- 2.	)	7.692 *				* NI7801	ALTD01	
92-U -236	A *	Y	(2.342	+- 0.004	)E+7	0.171 *	1.0			* L07901	ALTD01	
92-U -236	SF *	Y	(2.0	+- 1.0	)E+16		(1.2	+- 0.6	)E-9	50.000 *	RE7801	ALTD01 A
92-U -237	B- *	D	(6.75	+- 0.01	)	0.148 *				* L07901	ALTD01	
92-U -238	A *	Y	(4.468	+- 0.004	)E+9	0.090 *	1.0			* L07901	ALTD01	
92-U -238	SF *	Y	(8.19	+- 0.09	)E+15	1.099 *	(5.45	+- 0.06	)E-7	1.101 *	RE7901	ALTD01 B
92-U -239	B- *	M	(23.50	+- 0.05	)	0.213 *				* L07901	ALTD01	
92-U -240	B- *	H	(14.1	+- 0.2	)	1.418 *				* NI7801	ALTD01	
93-NP-236	T *	Y	(1.15	+- 0.12	)E+5	10.435 *				* L07901	ALTD01	C
93-NP-236	B- *	Y	(1.29	+- 0.32	)E+6	24.806 *	(0.089	+- 0.020	)	22.472 *	L07901	ALTD01 A
93-NP-236	EC *	Y	(1.262	+- 0.135	)E+5	10.697 *	(0.911	+- 0.020	)	2.195 *	L07901	ALTD01 A
93-NP-236M1	T *	H	(22.5	+- 0.4	)	1.778 *				* L07901	ALTD01	C
93-NP-236M1	B- *	H	(46.88	+- 1.28	)	2.730 *	(0.48	+- 0.01	)	2.083 *	L07901	ALTD01 A
93-NP-236M1	EC *	H	(43.27	+- 1.13	)	2.612 *	(0.52	+- 0.01	)	1.923 *	L07901	ALTD01 A
93-NP-237	A *	Y	(2.14	+- 0.01	)E+6	0.467 *	1.0			* L07901	ALTD01	
93-NP-237	SF *	Y	1.E+18				2.14E-12			* LE7801	ALTD01	B
93-NP-238	B- *	D	(2.117	+- 0.002	)	0.094 *				* L07901	ALTD01	
93-NP-239	B- *	D	(2.354	+- 0.006	)	0.255 *				* L07901	ALTD01	
93-NP-240	B- *	M	(65.	+- 3.	)	4.615 *				* NI7801	ALTD01	
93-NP-240M1	B- *	M	(7.4	+- 0.2	)	2.703 *	(0.9989	+- 0.0003	)	0.030 *	NI7801	ALTD01
93-NP-240M1	IT *	D	(4.68	+- 1.34	)	28.632 *	(0.0011	+- 0.0003	)	27.273 *	NI7801	ALTD01 A
93-NP-241	B- *	M	(16.	+- 0.2	)	1.250 *				* NI7801	ALTD01	
94-PU-236	A *	Y	(2.851	+- 0.008	)	0.281 *	1.0			* L07901	ALTD01	
94-PU-236	SF *	Y	(3.52	+- 1.	)E+9	28.409 *	(8.1	+- 2.3	)E-10	28.395 *	LE7801	ALTD01 B
94-PU-237	A *	Y	(3.77	+- 0.34	)E+3	9.019 *	(0.000033	+- 0.000003	)	9.091 *	LE7801	ALTD01 A
94-PU-237	EC *	D	(45.4	+- 0.2	)	0.441 *	0.9999			* LE7801	ALTD01	

94-PU-237

94-PU-237

NUCLIDE	DECAY MODE	* UNITS	DATA	HALF-LIFE			BRANCHING FRACTION			* REFERENCE	COMPILER REFERENCE	COMMENT			
				UNCERTAINTY	PER-CENT	*	DATA	UNCERTAINTY	PER-CENT						
94-PU-238	A	*	Y	(87.74	+- 0.09	)	0.103	*	1.0		* L07901	ALTD01		
94-PU-238	SF	*	Y	(4.77	+- 0.13)E+10	2.725	*	(1.84	+- 0.05)E-9	2.717	* RE7801	ALTD01	A
94-PU-239	A	*	Y	(2.411	+- 0.003	)E+4	0.124	*	1.0			* L07901	ALTD01	
94-PU-239	SF	*	Y	(5.5	+- 0.5)E+15	9.091	*	(4.4	+- 0.4)E-12	9.091	* RE7801	ALTD01	A
94-PU-240	A	*	Y	(6.55	+- 0.02	)E+3	0.305	*	1.0			* L07901	ALTD01	
94-PU-240	SF	*	Y	(1.2	+- 0.1)E+11	8.333	*	(5.5	+- 0.5)E-8	9.091	* BU7901	ALTD01	B
94-PU-241	A	*	Y	(6.00	+- 0.25)E+5	4.167	*	(2.45	+- 0.08)E-5	3.265	* LE7801	ALTD01	A
94-PU-241	B-	*	Y	(14.7	+- 0.4	)	2.721	*	0.999			* L07901	ALTD01	
94-PU-242	A	*	Y	(3.76	+- 0.02	)E+5	0.532	*	1.0			* L07901	ALTD01	
94-PU-242	SF	*	Y	(6.84	+- 0.08)E+10	1.170	*	(5.5	+- 0.06)E-6	1.091	* RE7801	ALTD01	A
94-PU-243	B-	*	H	(4.956	+- 0.005	)	0.101	*				* NI7801	ALTD01	
94-PU-244	A	*	Y	(8.2	+- 0.1	)E+7	1.220	*	1.0			* L07901	ALTD01	
94-PU-244	SF	*	Y	(6.56	+- 0.32)E+10	4.878	*	(1.25	+- 0.06)E-3	4.800	* RE7801	ALTD01	A
94-PU-245	B-	*	H	(10.5	+- 0.1	)	0.952	*				* NI7801	ALTD01	
94-PU-246	B-	*	D	(10.85	+- 0.02	)	0.184	*				* NI7801	ALTD01	
95-AM-240	A	*	Y	(3.05	+- 1.12)E+3	36.721	*	(1.9	+- 0.7)E-6	36.842	* NI7801	ALTD01	A
95-AM-240	EC	*	H	(50.8	+- 0.3	)	0.591	*	1.0			* NI7801	ALTD01	
95-AM-241	A	*	Y	(432.6	+- 0.6	)	0.139	*	1.0			* L07901	ALTD01	
95-AM-241	SF	*	Y	(1.06	+- 0.03)E+14	2.830	*	(4.1	+- 0.1)E-12	2.439	* RE7801	ALTD01	A
95-AM-242	T	*	H	(16.01	+- 0.02	)	0.125	*				* LE7801	ALTD01	C
95-AM-242	B-	*	H	(19.36	+- 0.07)	0.362	*	(0.827	+- 0.003)	0.363	* LE7801	ALTD01	A
95-AM-242	EC	*	H	(92.5	+- 1.6)	1.730	*	(0.173	+- 0.003)	1.734	* LE7801	ALTD01	A
95-AM-242M1	A	*	Y	(3.13	+- 0.15)E+4	4.792	*	(4.5	+- 0.2)E-3	4.444	* ZE7901	ALTD01	A
95-AM-242M1	SF	*	Y	(8.8	+- 3.3)E+11	37.500	*	(1.6	+- 0.6)E-10	37.500	* RE7801	ALTD01	A
95-AM-242M1	IT	*	Y	(141.	+- 2.	)	1.418	*	0.9955			* ZE7901	ALTD01	
95-AM-243	A	*	Y	(7.38	+- 0.04	)E+3	0.542	*	1.0			* L07901	ALTD01	
95-AM-243	SF	*	Y	(3.35	+- 0.31)E+13	9.254	*	(2.2	+- 0.2)E-10	9.091	* RE7801	ALTD01	A
95-AM-244	B-	*	H	(10.1	+- 0.1	)	0.990	*				* NI7801	ALTD01	
95-AM-244M1	B-	*	M	26.				*	(0.99959	+- 0.00003)	0.003	* NI7801	ALTD01	
95-AM-244M1	EC	*	D	44.0				*	(4.1	+- 0.3)E-4	7.317	* NI7801	ALTD01	A
95-AM-245	B-	*	H	(2.05	+- 0.01	)	0.488	*				* NI7801	ALTD01	
95-AM-246	H-	*	M	(39.	+- 3.	)	7.692	*				* NI7801	ALTD01	
95-AM-246M1	H-	*	M	(25.	+- 0.2)	0.800	*				* NI7801	ALTD01		
96-CM-241	T	*	D	(32.8	+- 0.2)	0.610	*				* NI7801	ALTD01	C	

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96-CM-241 PROPOSED RECOMMENDED TRANSACTINIUM ISOTOPE HALF-LIVES AND BRANCHING FRACTIONS

NUCLIDE	DECAY* MODE *	UNITS	DATA	HALF-LIFE		PER-CENT *	BRANCHING FRACTION			PER-CENT *	REFERENCE	COMPILER REFERENCE	COMMENT
				UNCERTAINTY			DATA	UNCERTAINTY					
96-CM-241	A *	Y	(8.98	+- 0.90	)	10.022 *	(0.010	+- 0.001	)	10.000 *	NI7801	ALTD01	A
96-CM-241	EC *	D	(33.1	+- 0.2	)	0.604 *	(0.990	+- 0.001	)	0.101 *	NI7801	ALTD01	A
96-CM-242	A *	D	(162.8	+- 0.4	)	0.246 *	1.0				LO7901	ALTD01	
96-CM-242	SF *	Y	(6.5	+- 0.6	)E+4	9.231 *	(6.8	+- 0.6	)E-6	8.824 *	RE7801	ALTD01	A
96-CM-243	T *	Y	(28.5	+- 0.2	)	0.702 *					EL7601	ALTD01	C
96-CM-243	A *	Y	(28.6	+- 0.2	)	0.699 *	(0.9976	+- 0.0004	)	0.040 *	NI7801	ALTD01	A
96-CM-243	EC *	Y	(1.19	+- 0.20	)E+4	16.807 *	(0.0024	+- 0.0004	)	16.667 *	NI7801	ALTD01	A
96-CM-244	A *	Y	(18.11	+- 0.02	)	0.110 *	1.0				LO7901	ALTD01	
96-CM-244	SF *	Y	(1.344	+- 0.002	)E+7	0.149 *	(1.347	+- 0.002	)E-6	0.148 *	RE7801	ALTD01	A
96-CM-245	A *	Y	(8500.	+- 100.	)	1.176 *					EL7601	ALTD01	
96-CM-246	A *	Y	(4.73	+- 0.1	)E+3	2.114 *	1.0				LO7901	ALTD01	
96-CM-246	SF *	Y	(1.81	+- 0.04	)E+7	2.210 *	(2.614	+- 0.005	)E-4	0.191 *	RE7801	ALTD01	A
96-CM-247	A *	Y	(1.56	+- 0.05	)E+7	3.205 *					NI7801	ALTD01	
96-CM-248	T *	Y	(3.397	+- 0.032	)E+5	0.942 *					RE7801	ALTD01	C
96-CM-248	A *	Y	(3.703	+- 0.035	)E+5	0.945 *	(0.9174	+- 0.0003	)	0.033 *	RE7801	ALTD01	A
96-CM-248	SF *	Y	(4.113	+- 0.041	)E+6	0.997 *	(0.0826	+- 0.0003	)	0.363 *	RE7801	ALTD01	A
96-CM-249	B-	M	(64.15	+- 0.07	)	0.109 *					NI7801	ALTD01	
96-CM-250	SF *	Y	(1.13	+- 0.05	)E+4	4.425 *					LE7801	ALTD01	
97-BK-249	T *	D	(320.	+- 6.	)	1.875 *					LE7801	ALTD01	C
97-BK-249	A *	Y	(6.04	+- 0.35	)E+4	5.795 *	(1.45	+- 0.08	)E-5	5.517 *	LE7801	ALTD01	A
97-BK-249	SF *	Y	(1.864	+- 0.087	)E+9	4.667 *	(4.7	+- 0.2	)E-10	4.255 *	RE7801	ALTD01	A
97-BK-250	B-	H	(3.217	+- 0.004	)	0.124 *					RE8001	ALTD01	
98-CF-249	A *	Y	(350.6	+- 2.1	)	0.599 *	1.0				LO7901	ALTD01	
98-CF-249	SF *	Y	(6.98	+- 0.15	)E+10	2.149 *	(5.02	+- 0.1	)E-9	1.992 *	RE7801	ALTD01	A
98-CF-250	A *	Y	(13.08	+- 0.09	)	0.688 *	1.0				LO7901	ALTD01	
98-CF-250	SF *	Y	(1.70	+- 0.07	)E+4	4.118 *	(7.7	+- 0.3	)E-4	3.896 *	RE7801	ALTD01	A
98-CF-251	A *	Y	(898.	+- 44.	)	4.900 *					NI7801	ALTD01	
98-CF-252	T *	Y	(2.64	+- 0.01	)	0.379 *					LO7901	ALTD01	C
98-CF-252	A *	Y	(2.72	+- 0.01	)	0.368 *	(0.96908	+- 0.00008	)	0.008 *	RE7801	ALTD01	A
98-CF-252	SF *	Y	(85.38	+- 0.39	)	0.457 *	(0.03092	+- 0.00008	)	0.259 *	RE7801	ALTD01	A
98-CF-253	T *	D	(17.81	+- 0.08	)	0.449 *					NI7801	ALTD01	C
98-CF-253	A *	Y	(15.73	+- 2.03	)	12.905 *	(0.0031	+- 0.0004	)	12.903 *	NI7801	ALTD01	A
98-CF-253	B-	D	(17.86	+- 0.08	)	0.448 *	(0.9969	+- 0.0004	)	0.040 *	NI7801	ALTD01	A
99-ES-253	A *	D	(20.4	+- 0.1)	0.490 *	1.0				KU8001	ALTD01	
99-ES-253	SF *	Y	(6.42	+- 0.22)E+5	3.427 *	(8.7	+- 0.3)E-8	3.448 *	RE7801	ALTD01	A

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COMMENTS

- A. Half-life derived from branching fraction
- B. Branching fraction derived from half-life
- C. Total half-life as defined here equals partial half-life multiplied by branching fraction.

