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NUCLEAR DATA LIBRARY FOR THE FISSION PRODUCT INVENTORY PROGRAM

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NUCLEAR DATA LIBRARY FOR THE FISSION PRODUCT PROGRAM

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NUCLEAR DATA LIBRARY FOR THE FISSION PRODUCT PROGRAM

I. Table of Nuclear Data

The Table of Nuclear Data includes the atomic number and chemical symbol, mass number, half-life, decay constant, fission yield, β -spectrum, and γ -spectrum of each nuclide.

1. Half-lives and the decay constants computed from them are compatible with those used by P. Zigman's group at the USNRDL⁽⁹⁾. Abbreviations used in the list of half-lives are:

S	-	Seconds
M	-	Minutes
H	-	Hours
D	-	Days
Y	-	Years

Decay constants are given in reciprocal seconds and, e.g., $.72963 \times 10^{-2} = .72963 \times 10^{-2}$.

2. Fission yields given are yields from thermal neutron fission of U^{235} and have been taken from Weaver, Strom, and Killeen⁽⁸⁾. In those cases where no energy spectra are available for a particular nuclide, and the nuclide does not contribute significantly to the total activity ($<0.1\%$ based on the FPIP), the fission yield for that nuclide has been assigned

to the next succeeding chain member. This re-assignment has been carried out only for early chain members and in no case has an entire chain been deleted.

3. β -and γ -spectral data have been obtained from the sources indicated in the Table.

Abbreviations refer to:

NDS	reference	(4)
NUS	reference	(5)
SHS	reference	(7)
Stehn	reference	(6)

Those references which appear with an asterisk (NDS* and NUS*) indicate that the details of the energy spectrum are not known but that the Q-value for the disintegration of that nuclide is available in the source given. In these cases, it has been assumed that half the total disintegration energy arises from β -decay and the remaining half from subsequent γ 's. The total decay has been divided accordingly in order to arrive at a more realistic estimate of the total fission energy spectrum than would be possible otherwise.

All decay energies are given in Mev.

II. Table of Decay Chains

The Table of Decay Chains is based on the table compiled by W. Henninger⁽²⁾ after consultation with the Applied Research Branch, U. S. Naval Radiological Defense Laboratory. The fission yield for the initial member of each chain has been obtained as described above and a few modifications of the original compilation have been made on

the basis of the decay schemes given in Nuclear Data Sheets. Where two or more isomers of the same nuclide appear, the fission yield given will be split equally between them. In those cases where isomers became initial chain members, the branching ratio for the decay of the parent nuclide has been taken into account.

The total chain yield is given at the end of each chain.

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FISSION PRODUCT DECAY CHAIN
(Fractional Fission Yields)

Sheet No. 1

					Chain Yield
72	$\overset{46.5}{\underset{47}{\text{H}}}\text{Zn}^{72}$ 1.30×10^{-7}	$\longrightarrow$	14.1-H Ga^{72} 1.00×10^{-8}	$\longrightarrow$	Stable Ge^{72} 0 1.4×10^{-7}
73	2.0-M Zn^{73} 1.05×10^{-6}	$\longrightarrow$	4.8-H Ga^{73} 4×10^{-8}	$\nearrow$ $0.53\text{-S Ge}^{73\text{m}}$ $\downarrow$ Stable Ge^{73} 0	1.09×10^{-6}
74	7.8-M Ga^{74} 3.44×10^{-6}	$\longrightarrow$	Stable Ge^{74} 0		3.44×10^{-6}
75	$49\text{-S Ge}^{75\text{m}}$ 1.146×10^{-5}	$\longrightarrow$	82-M Ge^{75} 5.00×10^{-8}	$\longrightarrow$	Stable As^{75} 1.151×10^{-5}
76	30-S Ga^{76} 3.322×10^{-5}	$\longrightarrow$	Stable Ge^{76} 1.81×10^{-6}		3.503×10^{-5}

Chain Yield

Chain Yield

5.02671×10^{-2}

119

$$1.988415 \times 10^{-2}$$

$$2.931623 \times 10^{-2}$$

$$\begin{array}{cc}
 \text{Stable Xe}^{132} & 4.380352 \times 10^{-2} \\
 0 &
 \end{array}$$

$$6.480632 \times 10^{-2}$$

Chain Yield: 8.033213×10^{-2}

Chain Yield: 6.524180×10^{-2}

Chain Yield: 6.018407×10^{-2}

 5.575730×10^{-2}

Nuclide	Mass No.	Half-life		Decay Constant (sec ⁻¹)		Fission Yield (Fractional)		E _β (max)	Energy of Radiation %		E _γ	%	Reference
30 Zn	72	47	H	.40966	-5	.1300	-6	0.3 1.6	95 5				NDS
	73	2.0	M	.57762	-2	.1050	-5	2.5	100	2.5	100		NDS*
31 Ga	72	14.1	H	.13655	-4	.1000	-7	0.66	17	0.601	7.2		NDS
								0.68	24	0.630	4.5		
								0.959	35	0.786	3		
								1.508	7	0.812	2.6		
								1.94	7	0.835	69		
								2.529	5	0.894	8		
								3.166	5	1.050	5.3		
										1.231	1.2		
										1.268	1.4		
										1.465	23.5		
										1.598	10.3		
										1.68	1.5		
										1.860	5.3		
										2.201	29		
										2.490	9		
										2.508	17		
	73	4.8	H	.40113	-4	.4000	-7	~ 0.40	7	0.295	97		NDS
								1.19	91	0.745	6		
								1.48	42	1.04	1		
	74	7.8	M	.14811	-2	.3440	-5	1.1	11	0.49	7.5		NDS
								1.84	4	0.596	76		
								2.05	3	0.60	3.7		
								2.27	10	0.87	9.5		
								2.65	69	1.00	7.4		
								4.3	3	1.10	6		
										1.20	11		
										1.31	2.2		

Nuclide	Mass No.	Half-life		Decay Constant (sec ⁻¹)		Fission Yield (Fractional)		E _β (max)	Energy of Radiation			Reference
									%	E γ	%	
										1.45	8	
										1.60	0.4	
										1.72	6.4	
										1.84	2.8	
										1.96	5.5	
										2.20	0.9	
										2.35	58.8	
										2.55	2.5	
										2.72	4	
										2.95	3.1	
										3.17	1.8	
										3.33	1.8	
										3.6	1.3	
	76	30	S	.23105	-4	.3322	-4					
32 Ge	73 m	.53	S	.13078	+1	0		0	0	0.0135	100	NDS
										0.0539	100	
	75 m	49	S	.14146	-1	.1146	-4	0	0	0.139	100	NDS
	75	82	M	.14088	-3	.5000	-7	0.55	0.41	0.066	0.3	NDS
								~0.72	0.29	0.199	1.4	
								0.92	11.4	0.265	11	
								0.98	1.4	0.427	0.3	
								1.19	86.5	0.477	0.3	
32 Ge	77 m	54	S	.12836	-1	.4842	-4	2.7	18	0.159	36	NUS
								2.9	46	0.215	18	

Nuclide	Mass No.	Half-Life		Decay Constant (sec ⁻¹)		Fission Yield (Fractional)		Energy of Radiation				Reference
								E_{β} (max.)	%	E_{γ}	%	
	77	11.3	H	.17039	-4	.3395	-4	0.38	3	0.153	1.1	NUS
								0.76	15	0.21	62.5	
								1.20	11	0.265	56.3	
								1.30	4	0.368	17.0	
								1.56	24	0.416	27.2	
								2.12	29	0.563	15.2	
								2.27	14	0.632	11.3	
										.709	10.1	
										0.80	1.4	
										0.92	6.4	
										1.08	7.8	
										1.19	1.4	
										1.37	7.1	
										1.50	2.1	
										1.74	0.5	
										1.96	0.2	
										2.02	4.5	
										2.32	0.7	
	78	2.1	H	.91687	-4	.19633	-3	0.9	100	0	0	NDS
33 As	77	38.7	H	.49752	-5	.1100	-6	0.16	2.8	0.246	2.8	NDS
								0.438	2.8	0.524	2.7	
								0.684	94.4			
	78m	6.0	M	.19254	-2	.2325	-5	0	0	0.50	100	NDS
33 As	78	91	M	.12695	-3	.2325	-5	1.42	2.2	0.080	1.2	NUS
								1.49	2.1	0.270	2	
								1.60	14	0.345	1.2	
								1.86	6.2	0.615	42	
								2.96	9.7	0.695	15.5	
								3.65	19	0.83	7.9	
								4.27	47	0.99	2.5	
										1.10	2.9	
										1.21	4.2	
										1.31	10.8	

Nuclide	Mass No.	Half-Life	Decay Constant		Fission Yield		Energy of Radiation				Reference	
			(sec ⁻¹)		(Fractional)		E _β (max.)	%	E _γ	%		
34 Se										1.49	2.1	
										1.70	1.7	
										1.82	1.4	
										1.94	1.5	
										2.05	1.0	
										2.24	1.0	
										2.65	1.4	
	79	9.0	M	.12836	-2	.55623	-3	1.1	100	1.1	100	NDS*
	80	36	S	.19254	-1	.93827	-3	3.25	100	3.25	100	NDS*
	81	50	S	.13863	-1	.135785	-2	1.9	100	1.9	100	NDS*
	82	18	S	.38508	-1	.228093	-2	3.7	100	3.7	100	NDS*
	85	0.4	S	.17329	+1	.440076	-2	4	100	4	100	NDS*
	79m	3.89	M	.29698	-2	0		0	0	0.096	100	NUS
79	6 x 10 ⁴	Y	.36603	-12	0		0.16	100	0	0	Stehn	
81m	57	M	.20268	-3	.2626	-4	0	0	0.103	100	NUS	
81	18.4	M	.62785	-3	.2626	-4	1.38	100	0	0	NUS	
83m	69	S	.10046	-1	.242529	-2	1.5	10	0.35	<10	NUS	
							3.4	90	0.65	<10		
									1.01	10 5		
									2.02	10 5		
83	25	M	.46210	-3	.299488	-2	1.5	100	0.35		NUS	
									0.65	100 50		
									1.01	100 50		
84	3.0	M	.38508	-2	.980192	-2	0.95	100	0.95	100	NUS*	

Nuclide	Mass No.	Half-life	Decay Constant (sec ⁻¹)		Fission Yield (Fractional)		E _{β} (max)	Energy of Radiation		E _{γ}	%	Reference
								%				
	85	39	S	.17773	-1	.609244	-2	2.5	100	2.5	100	NUS*
	86	16	S	.43322	-1	.1250019	-1	2	100	2	100	NDS*
	87	17	S	.40774	-1	.1087435	-1	4	100	4	100	NUS*
35 Br	83	2.4	H	.80226	-4	.7130	-5	0.91 0.96	20 80	0.046	20	NUS
	84	32	M	.36102	-3	2481	-3	0.50	3	0.27 0.35 0.43 0.47 0.52 0.61 0.74 0.81 0.880 1.01 1.21 1.47 1.51 1.74 1.90 2.05 2.17 3.03 3.28 3.93	0.5 1.0 2.1 0.9 2.4 2.3 2.9 6.3 41.7 8.8 3.2 1.7 1.0 2.0 15.0 1.6 1.6 3.0 2.4 10.4	NDS
	85	3.0	M	.38508	-2	.2501	-2	2.5	100	0	0	NUS
	86	60	S	.11552	-1	.64926	-2	4	100	4	100	NDS*
	87	54.5	S	.12718	-1	.1070428	-1	2.6 8.0	70 30	~ 3 5.4	14 56	NUS
	88	16.5	S	.42009	-1	.2605943	-1	4.85	100	4.85	100	NDS*

Nuclide	Mass No.	Half-life		Decay Constant (sec ⁻¹)		Fission Yield (Fractional)		E _α (max.)	Energy of Radiation %		E _γ	%	Reference
	89	4.4	S	.15753	0	.2580241	-1	4.5	100		4.5	100	NDS*
36 Kr	83m	114	M	.10134	-3	0	0	0	0		0.0096	100	NUS
	85m	4.4	H	.43759	-4	.5552	-4	0.824	81		0.15 0.305	81 19	NUS
	85	10.6	Y	.20721	-8	.5552	-4	0.15 0.672	1 99		0.514	1	NUS
	87	78	M	.14811	-3	.328131	-2	1.25 3.3 3.8	25 10 65		0.403 0.847 2.05 2.57	87 13 <3 22	NUS
	88	2.88	H	.66855	-4	.869348	-2	0.52 0.9 2.7	70 10 20		0.028 0.166 0.191 0.36 0.845 1.19 1.55 1.85 2.19 2.40	7 7 35 5 23 <4 14 <15 <18 35	NUS
	89	3.16	M	.36559	-2	.206613 .17507	-4 -1	2.0 3.9	35 65		0	0	NUS
	90	33	S	.21005	-1	.4418467	-1	3.2	100		0	0	NUS
	91	10	S	.69315	-1	.3846738	-1	1.8	100		1.8	100	NDS*
	92	3	S	.23105	-1	.285014	-1	3.0	100		3.0	100	NDS*
37 Rb	87	4.3 x 10 ¹⁰ Y		.51080	-18	.4282	-4	0.273	100		0	0	NDS

Nuclide	Mass No.	Half-life		Decay Constant (sec ⁻¹)		Fission Yields (Fractional)		Energy of Radiation				Reference
								E_{β} (max.)	%	E_{γ}	%	
	93	8.0	M	.14441	-2	.6332533	-1	2.0	100	2.0	100	NDS*
	94	1.3	M	.88865	-2	.5940576	-1	1.7	100	1.7	100	NDS*
	95	40	S	.17329	-1	.5294117	-1	2.25	100	2.25	100	NDS*
	97	1.5	S	.46210	0	.613245	-2	3.5	100	3.5	100	NDS*
39 Y	89m	16	S	.43322	-1	0		0	0	0.91	100	Stehn
	90	64.2	H	.29991	-5	0		2.27	100	0	0	NUS
	91m	51	M	.22652	-3	0	0	0	0	0.551	100	NUS
	91	58	D	.13832	-6	0		0.33 1.54	0.3 100	1.208	0.3	NUS
	92	3.5	H	.55012	-4	.6052	-4	1.26 1.75 3.6	9 3 88	1.84 2.4	3 9	NUS
	93	10.3	H	.18693	-4	.103041	-2	0.45 0.71 1.47 1.95 2.62 2.89	0.15 1.8 0.9 3.0 3.9 90	0.267 0.49 0.665 0.935 1.15 1.42 1.90 2.41 2.18	6.6 0.03 0.7 2.3 0.2 0.7 1.6 0.05 0.3	NUS
	94	20	M	.57762	-3	.445178	-2	5.0	40	0.56 0.92 1.13	6 43 5	Stehn
	95	10	M	.11552	-2	.944378	-2	2.35	100	2.35	100	NDS*

Nuclide	Mass No.	Half-life	Decay Constant (sec ⁻¹)	Fission Yield (Fractional)	E _β (max.)	%	E _γ	%	Reference
	96	2.3 M	.50228 -2	.602821 -1					
39 Y	97	5.0 S	.13863 0	.2460984 -1	2.75	100	2.75	100	NDS*
40 Zr	93	9.5 x 10 ⁵ Y	.23120 -13	0	0.034 0.063	25 75	0.029	25	NDS
	95	65 D	.12342 -6	.18908 -3	0.360 0.396 0.885 1.13	43 55 2 0.4	0.235 0.720 0.760	2 55 43	NUS, NDS
	97	17.0 H	.11326 -4	.2410964 -1	0.45 1.91	10 90	1.02 1.15	1 2	NUS
	98	60 S	.11552 -1	.5614245 -1	2.25	100	2.25	100	NDS*
	99	^{1.6} 33 S	^{.43323} .21005 0	.537715 -1	1.8	100	1.8	100	NDS*
41 Nb	93m	3.7 Y	.59364 -8	0	0	0	0.029	100	NDS
	95m	90 H	.21394 -5	0	0	0	0.235	100	NUS
	95	35 D	.22922 -6	0	0.160 0.93	99 1	0.762	99	NUS
	97m	60 S	.11552 -1	.297619 -2	0	0	0.75	100	NUS
	97	73 M	.15825 -3	.297619 -2	0.93 1.267	1 99	0.665 1.02	99 1	NUS
	98m	51 M	.22652 -3	.860345 -3	3.1	41	0.72 0.78 1.16 1.68 1.88	75 100 30 10 4	NUS

Nuclide	Mass No.	Half-life		Decay Constant (sec ⁻¹)		Fission Yield (Fractional)		E _β (max.)	%	E _γ	%	Reference
		4.5		.25672	-2							
	98	26	M	.4433	-3	.860345	-3	2.1	100	2.1	100	NDS *
	99	2.3	M	.50227	-2	.681273	-2	1.6	100	1.6	100	NDS* NRDL
	100	3.0	M	.38508	-2	.6021908	-1	3.45	100	3.45	100	NDS*
	101	1.0	M	.11552	-1	.42507	-1	1.25	100	1.25	100	NDS*
42 Mo	99	66.5	H	.28954	-5	.8053	-4	0.45	14	0.372	1	NUS
								0.87	1	0.740	10	
								1.23	85	0.780	4	
	101	14.6	M	.79127	-3	.760304	-2	0.6	3	0.08	3	NUS
								0.7	38	0.191	27	
								0.8	13	0.300	7	
								1.2	11	0.40	2	
								1.6	25	0.51	16	
								2.23	10	0.59	21	
										0.70	12	
										0.84	1	
										0.89	15	
										0.95	2	
										1.024	25	
										1.14	1	
										1.18	11	
										1.28	3	
										1.38	9	
										1.46	1	
										1.56	11	
		1.66	3									
		2.08	16									
102	11.5	M	.10046	-2	.3977691	-1	1.2	100			NUS	
104	2.5	M	.46210	-2	.1446278	-1						
105	2.0	M	.57762	-1	.698479	-2	2.75	100	2.75	100	NDS*	

Nuclide	Mass No.	Half-life		Decay Constant (sec ⁻¹)		Fission Yield (Fractional)		E _β (max.)	%	E _γ	%	Reference
43 Tc	99m	6.0	H	.32090	-4	0		0	0	0.002 0.140 0.142	98.6 98.6 1.4	NUS
	99	2.1 × 10 ⁵ Y		.10459	-12	0		0.292	100	0	0	
	101	14.0	M	.82518	-3	.15706	-3	1.07 1.32	8 90	0.307 0.543	90 8	
	102 m	4.5	M	.25672	-2	.70528	-3	2	100	2.1	100	NDS*
	102	5	S	.13863	0	.70528	-3	2.05	100	2.05	100	NDS*
	103	72	S	.96271	-2	.297891	-1	1.25	100	1.25	100	NDS*
	104	18	M	.64181	-3	.340136	-2	2.4	100	2.6	100	NDS*
	105	9.0	M	.12836	-2	.198079	-2	1.7	100	1.7	100	NDS*
	107	60	S	.11552	-1	.182703	-2	3	100	3	100	NDS*
44Ru	103	39.7	D	.20208	-6	0		0.10 0.212 0.39 0.71	7 89 1 3	0.323 0.498 0.610	3 89 7	NUS
	105	4.45	H	.43268	-4	.7763	-4	0.526 0.915 1.080 1.145 1.87	4 8 30 48 10	0.263 0.318 0.400 0.475 0.485 0.670 0.726 0.874 0.966	5 10.6 5.6 16 5 15 48 4.3 3	NUS
	106	1.00	Y	.21965	-7	.392246	-2	0.039	100	0	0	NUS

Nuclide	Mass No.	Half-life		Decay Constant (sec ⁻¹)		Fission Yield (Fractional)		E _β (max.)	%	E _γ	%	Reference
45 Rh	107	4.6	M	.25114	-2	.8063	-4	3.0	12	0.195	17	NUS
								3.8	9	0.86	8	
								4	79	1.03	4	
	108	4.3	M	.26866	-2	.70038	-3	1.15	28	0.165	28	NDS
								1.32	72			
	103m	57	M	.20268	-3	0		0	0	0.040	100	NUS
	105m	38	S	.18241	-1	0		0	0	0.129	100	NUS
	105	36	H	.53484	-5	0		0.25	10	0.319	10	NUS
								0.565	90			
	106	30	S	.23105	-1	0		2.0	2	0.513	20.5	NUS
								2.4	11	0.612	1	
								3.0	8	0.624	9.9	
								3.54	78	1.045	1.5	
46 Pd	107	22	M	.52511	-3	0		0.9	3	0.305	84	NUS
								1.1	13	0.39	13	
								1.2	84	0.68	3	
	108	18	S	.38508	-1	0		3.5	22	0.433	43	NDS
								4.1	17	0.617	22	
								4.5	51			
	109m	50	S	.13863	-1	.150385	-3	0	0	0.11	100	NDS
	109	30	S	.23105	-1	.150385	-3	1.4	100	1.4	100	NDS*
	110	3.6	S	.19254	0	.17776	-3					
	107	7 × 10 ⁶	Y	.31378	-14	0		0.035	100	0	0	NDS
	109m	4.7	M	.24580	-2	0		0	0	0.18	100	NDS

Nuclide	Mass No.	Half-life		Decay Constant (sec ⁻¹)		Fission Yield (Fractional)		E _β (max.)	%	E _γ	%	Reference
10	109	14	H	.13753	-4	0		1.025	100	0	0	NUS
	111m	5.5	H	.35008	-4	.2080	-5	0.61	32	0.17	68	NDS
	111	23	M	.50228	-3	.17884	-3	2.13	100	0	0	NUS
	112	21	H	.91687	-5	.10008	-3	0.28	100	0.018	100	NUS
	113	84	S	.82518	-2	.16048	-3	1.65	100	1.65	100	NDS*
	114	2.4	M	.48135	-2	.1355	-3	1.4	100	0	0	NDS
	115	45	S	.15403	-1	.10285	-3	2.25	100	2.25	100	NDS*
47 Ag	109m	39	S	.17773	-1	0	0	0	0	0.088	100	NUS
	111m	74	S	.93669	-2	0	0	0	0	0.065	100	NDS
	111	7.6	D	.10556	-5	0		0.69	6.2	0.095	0.1	NUS
								0.79	1.1	0.247	1.2	
								1.05	92.7	0.342	6.1	
	112	3.12	H	.61712	-4	0		1.22	2.6	0.615	6.5	NUS
								1.34	3.6	0.69	4.5	
								1.50	1.8	0.855	1.6	
								1.61	2.0	0.98	1.2	
								1.78	4.4	1.09	1.2	
								2.01	5.3	1.31	1.4	
								2.20	0.6	1.40	5.3	
								2.57	1.6	1.49	1.2	
								2.63	0.9	1.62	3.2	
								2.73	2.8	2.11	3.2	
								3.42	18	2.54	1.0	
								4.04	56			
	113m	72	S	.96271	-2	0		<2	10	0.3	90	NDS
	113	5.3	H	.36329	-4	0		1.7	100	2	7	NDS

Nuclide	Mass No.	Half-life		Decay Constant (sec ⁻¹)		Fission Yield (Fractional)		E _{β} (max.)	%	E _{γ}	%	Reference
48 Cd	114	5.0	S	.13863	0	.1860	-5	2.3	100	2.3	100	NDS*
	115m	20	S	.34657	-1	.3530	-5	2.9	28	1.2	72	NDS
	115	21	M	.55012	-3	.3530	-5	2.7 2.9	9 91	0.138 0.227	Weak Weak	NDS
	116	2.5	M	.46210	-2	.18025 ^{.18525}	-3	5.0	100	0.52 0.70	100 100	NDS
	117	66	S	.10502	-1	.10614	-3	1.9	100	1.9	100	NDS*
	115m	43	D	.18567	-6	0		0.335 0.687 1.63	1 2 97	0.48 0.935 1.3	0.3 2.3 1	NDS
	115	53	H	.36329	-5	0		0.59 0.63 0.85 1.11	24.4 12.6 0.9 62.1	0.26 0.49 0.523	1.7 12.2 24	NUS
	117m	3.0	H	.64181	-4	.1940	-5	1.0	<100	0.28 1.27	100 100	NDS
	117	50	M	.23105	-3	.1940	-5	2.3	<100	0.425	100	NUS
	118	50	M	.23105	-3	.14236	-3	0.8	100	0	0	NUS
	119 m	9.5 ^{9.5}	M	.10502 ^{.12160}	-2	.7013	-4	1.8 3.5	20 80	1.8	20	NDS
	119 m	2.7 ^{2.7}	M	.38508 ^{.42787}	-2	.7013	-4	1.85	100	1.85	100	NDS*
121	25	S	.27726	-1	.12005	-3	2.4	100	2.4	100	NDS*	
49 In	115m	4.51	H	.42692	-4	0		0.84	5.5	0.335	94.5	NUS

Nuclide	Mass No.	Half-life		Decay Constant (sec ⁻¹)		Fission Yield (Fractional)		E _β (max.)	%	E _γ	%	Release
	115	6 x 10 ⁴	Y	.36608	-22	0		0.50	100	0	0	NDS
	117m	2.0	H	.96271	-4	0		0.95 1.62 1.77	4 23 53	0.161 0.31 0.822	23 20 4	NDS
	117	45	M	.25672	-3	0		0.740	100	0.161 0.565	100 100	NDS
	118	5.0	S	.13863	0	0		3.3 4.5	20 80	1.22	20	NDS
	119m	18	M	.64181	-3	.7500	-6	1.8 2.7	6 90	0.30 0.907	4 6	NDS
	119	2.3	M	.50228	-2	.7500	-6	1.6	100	0.024 0.82	<90 <90	NDS
	120	50	S	.13863	-1	.14091	-3	2.2	100	0.089 0.199 1.04 1.18	100 100 100 100	NDS
	121m	3.1	M	.37266	-2	.10105	-4	1.85	100	1.85	100	NDS*
	121	30	S	.23105	-1	.10105	-4	2.9	100	0.94	100	NDS
	122	45	S	.15403	-1	.14366	-3	3	100	3	100	NDS*
	123m	36	S	.19254	-1	.73135	-4	2.3	100	2.3	100	NDS*
	123	10	S	.69315	-1	.73135	-4	3.3	100	1.10	100	NDS
	124	20	S	.34657	-1	.14175	-3					

Nuclide	Mass No.	Half-life		Decay Constant (sec ⁻¹)		Fission Yield (Fractional)		E _{β} (max.)	%	E _{γ}	%	Reference
50 Sn	117m	14	D	.57304	-6	0		0	0	0.159	100	NDS
	119m	245	D	.32738	-7	0		0	0	0.161	100	NUS
	121m	5.0	Y	.43929	-8	.1700	-6	0.42	100	0.0242 0.0653 0.01	100 100 100	NDS
	121	27.0	H	.71312	-5	.1700	-6	0.383	100	0	0	NUS
	123m	125	D	.64181	-7	.7605	-5	0.34 1.42	2 98	1.08	2	NUS
	123	41	M.	.28177	-3	.7605	-5	1.26	100	0.16	100	NUS
	125m	9.7	M	.11910	-2	.10169	-3	0.65 2.04	2.2 97.8	0.326 0.64 1.068 1.39	99.7 0.3 0.3 1.9	NUS
	125	9.4	D	.85346	-6	.10169	-3	0.37 0.47 1.3 2.33	2.1 1.5 1.3 95	0.468 0.811 0.904 1.068 1.97	0.5 1.0 0.9 3.9 1.2	NUS
	126	2 x 10 ⁵	Y	.10982	-12	.27472	-3	0.4	100			NDS
	127	2.6 2.0	H	.644231 .96271	-4	.106743	-2	1.6	100	1.6	100	NDS*
	128	57	M	.20268	-3	.238096	-2	1.3	100	0	0	NUS
	129	1.8	H	.10697	-3	.449309	-2	2.0	100	2.0	100	NDS*
	130	2.6	M	.44433	-2	.953381	-2	1.0	100	1.0	100	NDS*
	131	3.4	M	.33978	-2	.1151461	-1	2.5	100	2.5	100	NDS*
	132	2.2	M	.52511	-2	.931972	-2	1.5	100	1.5	100	NDS*

Nuclide	Mass No.	Half-life		Decay Constant (sec ⁻¹)		Fission Yield (Fractional)		E _β (max.)	%	E _γ	%	Reference
	126	12.5	D	.64181	-6	.2196	-4	1.9	100	0.415 0.665 0.695	100 100 100	NDS
	127	91	H	.21158	-5	.20708	-3	0.8 0.86 1.11 1.50	35 10 35 20	0.06 0.25 0.31 0.46 0.77	4 14 6 54 24	NUS
	128m	10.3 11.0	M	.11216 .10560	-2	.585235	-3	1.0	100	0	0	NUS
	128	9.8 8.6	H	.19647 .22384	-4	.585235	-3	1.45	100	1.45	100	NDS*
	129	4.6	H	.41857	-4	.291116	-2	1.0 1.87	80 20	0.534 0.165 0.308 0.788	20 80 26.7 80 26.7 80 26.7	NUS
	130	7.1	M	.16271	-2	.812325	-2	2.5	100	2.5	100	NDS*
	131	23	M	.50228	-3	.1310524	-1	1.6	100	1.6	100	NDS*
	132	2.1	M	.55012	-2	.2060824	-1	3	100	3	100	NDS*
	133	4.1	M	.28177	-2	.332533	-1	2	100	2	100	NDS*
	134	48	S	.14441	-1	.1805722	-1	4.3	100	4.3	100	NUS*
	135	6.0	S	.11552	0	.437175	-2	3.5	100	3.5	100	NDS*
52 Te	125m	58	D	.13832	-6	0		0	0	0.0353 0.110	100 100	NDS
	127m	105	D	.76405	-7	.13005	-4	0.054 0.73	0.013 1.5	0.059 0.0887 0.665	1.5 98.5 0.013	NDS

Nuclide	Mass No.	Half-life		Decay Constant (sec ⁻¹)		Fission Yield (Fractional)		E _β (max.)	%	E _γ	%	Reference
	127	9.3	H	.20703	-4	.13005	-4	0.27 0.695	1 99	0.059 0.360 0.418	0.12 0.12 0.83	
	129m	37	D	.21683	-6	.309625	-3	0	0	0.1063	100	NUS
	129	72	M	.16045	-3	.309625	-3	0.3 0.7 0.99 1.453	1 3 16 80	0.0268 0.475 0.72 0.211 1.12	80 16 3 1.5 3 1.5 1	NDS, NUS
	131m	30	H	.64181	-5	.23009	-2	0.215 0.420 0.570 2.457	3.0 43 31 3.8	0.08 0.100 0.200 0.240 0.335 0.780 0.840 0.920 1.08 1.14 1.22 1.620 1.92 2.0 2.24	4 8 8 3 16 80 40 5 5 25 17 3 2 4 15	NUS
	131	24	M	.48135	-3	.23009	-2	1.15 1.36 1.68 2.14	10 5 25 60	0.145 0.454 0.600 0.920 0.985 1.13	80 20 5 5 1 10	NUS
	132	78	H	.24685	-5	.1220488	-1	0.22	100	0.052 0.233	100 100	NDS

Nuclide	Mass No.	Half-life	Decay Constant (sec ⁻¹)	Fission Yield (Fractional)	E _β (max.)	%	E _γ	%	Reference
53 I	133m	52 M	.22216 -3	.1305522 -1	1.3	70	0.334	13	NDS
					2.4	17	0.432	70	
							0.754	100	
							0.91	70	
	133	2 M	.57762 -2	.1305522 -1	2.4	100	0	0	NIJS
	134	44 M	.26256 -3	.3781513 -1	1.4	100			NIJS
	135	1.4 M	.82518 -2	.2250900 -1	3	100	3	100	NDS*
	129	1.6 x 10 ⁷ Y	.13727 .13727 -14	.0	0.15	100	0.040	100	NDS
	130	12.6 H	.15281 -4	.5622 -4	0.60	47	0.410	24	NDS
					1.02	53	0.53	100	
							0.66	100	
							0.74	70	
							1.15	30	
	131	8.05 D	.99659 -6	.9454 -4	0.250	2.8	0.284	5.5	NIJS
					0.33	9.1	0.364	81	
					0.606	87.5	0.638	9.1	
					0.81	0.7	0.724	2.8	
	132	2.30 H	.83714 -4	.167067 -2	0.80	21	0.24	1.3	NUS
					1.04	15	0.32		
					1.22	12	0.46	2.2	
					1.49	12	0.48		
					1.61	21	0.52	19	
					2.14	18	0.62	5.2	
					2.92	0.03	0.647	9	
							0.65	26	
							0.673	99	
							0.72	6.5	
							0.775	82+	
							0.95	19	
							1.14	4.5	

Nuclide	Mass No.	Half-life		Decay Constant (sec ⁻¹)		Fission Yield (Fractional)		E _β (max.)	%	E _γ	%	Reference
53 I	132									1.30		
										1.40	8.3	
										1.45	1.4	
										1.50	1.8	
	133	20.8	H	.92568	-5	.655258	-2	0.65	9	0.53	100	NUS
								1.3	91	0.87	9	
										1.3	4	
	134	53	M	.21797	-3	.2170868	-1	0.5	6.5	0.14	3	NUS
								1.05	1.0	0.39	7	
								1.25	23	0.41	0.5	
								1.49	15	0.43	3	
								1.68	7.5	0.51	1	
								1.81	9.5	0.54	8	
								2.21	12	0.61	18	
								2.41	25	0.69	7	
										0.75	1	
										0.77	6	
										0.848	95	
										0.86	4.5	
										0.89	70.5	
										0.96	2	
									1.00	4.5		
									1.07	18		
									1.15	9.5		
		1.46	3.5									
		1.49	1									
		1.62	5									
		1.79	5									
135	6.68	H	.28824	-4	.285114	-1	0.47	35	0.42	26	NUS	
							1.0	40	1.28	100		
							1.4	25	1.69	46		
136	84 83	S	.32518 .83672	-2	.3924269	-1	2.73	6	0.20	12	NUS	
							4.16	5	0.39	19+		
							4.37	24	0.46	1		

Nuclide	Mass No.	Half-life		Decay Constant (sec ⁻¹)		Fission Yield (Fractional)		E _β (max.)	%	E _γ	%	Reference
53 I	136							5.60	15	0.53		
								7.0	6	0.71	3	
								3.5	44	1.00	6	
										1.32	95	
										1.55	4	
										1.72	2	
										1.91	5	
										2.25	7	
										2.40	13	
										2.63	11	
										2.84	8	
										3.2	5	
	137	24.4	S	.28408	-1	.2661064	-1	2.75	100	2.75	100	NDS
	138	6.3	S	.11002	0	.1457583	-1	3.9	100	3.9	100	NDS*
	139	2.0	S	.34657	0	.784884	-2	3.5	100	3.5	100	NDS*
54 Xe	131m	12	D	.66855	-6	0	0	0	0	0.164	100	NUS
	133m	2.3	D	.34881	-5	0	0	0	0	0.233	100	NUS
	133	5.27	D	.15223	-5	0	0	0.268	1	0.079	0.8	NDS
								0.347	99	0.081	100	
	135m	^{15.3} 15.6	M	^{1.75305} .24054	-3	.465186	-2	0	0	0.53	100	NUS
	135	9.2	H	.20928	-4	.465186	-2	0.55	3	0.250	97	NUS
								0.91	97	0.36	<1	
										0.604	3	
	137	3.9	M	.29622	-2	.2661064	-1	3.5	100	0	0	NUS
138	17	M	.67956	-3	.2751100	-1	2.4	100	0.42	100	NUS	
139	41	S	.16906	-1	.2751100	-1	4.6	100			NUS	

Nuclide	Mass No.	Half-life	Decay Constant (sec ⁻¹)		Fission Yield (Fractional)		E _β (max.)	%	E _γ	%	Reference
55 Cs	140	16 S	.43322	-1	.2306922	-1	2	100	2	100	NUS*
	135	2.0 x 10 ⁶ Y	.10982	-13	0		0.21	100	0	0	NDS
	136	13 D	.61712	-6	.377151	-2	0.341 0.657	92.6 7.4	0.152	19	NUS
									0.27	22	
									0.337	59	
									0.830	100	
									1.065	84	
									1.255	21	
	137	30 Y	.73215	-9	.815326	-2	0.514 1.18	95 5	0	0	NUS
	138	32 M	.36102	-3	.140056	-1	1.49	<0.5	0.1389	2	NUS
							2.20	10	0.1931	0.8	NUS
							2.39	36	0.2289	1.6	
							2.53	5	0.4106	3	
							2.62	16	0.4626	23	
							2.94	12	0.55	8	
							3.4	21	0.87	4	
									1.010	25	
									1.426	73	
									2.21	18	
									2.63	9	
									3.34	0.5	
56 Ba	139	9.5 M	.12161	-2	.2440976	-1	2.7	16	0.63	4	NUS
							3.4	4	1.28	16	
							4.0	80			
	140	66 S	.10502	-1	.2961184	-1	3	100	3	100	NDS*
	142	68 ⁸ S	.11552 .86644	-1 -1	.2857142	-1	4.3	100	4.3	100	NDS*
56 Ba	137m	2.6 M	.44433	-2	.58525	-4	0	0	0.662	100	NUS

Nuclide	Mass No.	Half-life		Decay Constant (sec ⁻¹)		Fission Yield (Fractional)		E _β (max.)	%	E _γ	%	Reference
56 La	139	85	M	.13591	-3	.547219	-2	2.17 3.34 2.34	28 72	0.166 1.09 1.26 1.34 1.43	28 0.01 0.04 0.01 0.3	NUS, NDS
	140	12.8	D	.62676	-6	.1120448	-1	0.5 0.6 0.9 1.0	25 10 5 60	0.03 0.16 0.30 0.54	100 10 10 30	NUS
	141	18	M	.64181	-3	.6096938	-1	1.4	100	1.4	100	NDS*
	142	10	M	.11552	-2	.2490996	-1	1.15	100	1.15	100	NDS*
	143	13	S	.53319	-1	.4471788	-1	1.75	100	1.75	100	NDS*
	140	40.2	H	.47896	-5	.37115	-3	0.83 1.10 1.38 1.71 2.20	12 26 45 10 7	1.596 2.08 2.41 2.65 2.92	7 10 45 26 12	NDS
	141	3.8	H	.50669	-4	.341136	-2	1.06 2.43	2 98	1.37	2	NDS, NUS
	142	84	M	.13753	-3	.670268	-2	4.5	100	0.64 0.90 2.40	55 12 11	NUS, Stehn
	143	18	M	.64181	-3	.1430572	-1	1.65	100	1.65	100	NDS*
	144	15 12	5 14	.46210 .50803	-1 -3	.5190576	-1	2.85	100	2.85	100	NDS*
58 Ce	141	33	D	.24311	-6	0	0.435 0.580	70 30	0.145	70	NUS	

Nuclide	Mass No.	Half-life		Decay Constant (sec ⁻¹)		Fission Yield (Fractional)		E _β (max.)	%	E _γ	%	Reference
	143	33	H	.58346	-5	.125050	-2	0.22	6	0.0574	105	NUS
								0.52	12			
								0.72	5			
								1.09	40	0.294	43	
								1.38	37	0.351	8	
										0.565	11	
										0.668	10	
										0.722	9	
										0.861	1	
										1.10	9	
	144	285	D	.28149	-7	.385154	-2	0.186	20	0.0337	10	NUS
								0.24	8	0.054	10	
								0.32	72	0.0807	10	
										0.100	10	
										0.134	10	
58 Ce	145	3.0	M	.38508	-2	.3942576	-1	1.0	100	1.0	100	NDS*
	146	13.9	M	.83112	-3	.2970188	-1	0.7	<100	0.110	57	NUS
										0.142	7	
										0.22	36	
										0.27	24	
										0.32	12	
59 Pr	147	1.2	M	.96271	-2	.215086	-1					
	143	13.8	D	.58135	-6	0		0.933	100	0	0	NUS
	144	17.3	M	.66777	-3	0		0.8	1	0.69	1.3	NUS, Stehn
								2.29	1.3	1.49	0.3	
								2.98	97.7	2.18	0.8	
	145	5.90	H	.32634	-4	.11104	-3	1.8	100			NUS
	146	24.4	M	.47346	-3	.112045	-2	2.3	44	0.46	100	NUS
								3.7	56	0.75	22	

Nuclide	Mass No.	Half-life		Decay Constant (sec ⁻¹)		Fission Yield (Fractional)		E _β (max.)	%	E _γ	%	Reference
59 Pr	146									1.49	33	
	147	12.0	M	.96271	-3	.221088	-2					
	148	1.95	M	.59244	-2	.1695078	-1	2.5	100	2.5	100	NDS*
	150	15	S	.46210	-1	.445528	-2					
60 Nd	147	11.1	D	.72275	-6	0		0.212 0.368 0.810	3 20 77	0.091 0.532 0.668	77 20 3	NUS
	149	2.0	H	.96271	-4	.11297-11	-1	0.95 1.1 1.5	15 43 31	0.0965 0.1123 0.1141 0.1241 0.1878 0.1979 0.2105 0.2261 0.2664 0.2400 0.4235 0.538	4 11 43 6 3 2.5 41 3 10 31 5 5	NUS
	151	13	M	.88865	-3	.419327	-2	0.24 0.54 1.19 1.65 1.82 2.06	< 1 3 30 7 15 45			NUS
	152	3.0	M	.38508	-2	.23696	-2					
61 Pm	147	2.6	Y	.84479	-8	0		0.225	100	0	0	NUS
	149	53.0	H	.36328	-5	0		0.1071	97	0.286	3	NDS

Nuclide	Mass No.	Half-life		Decay Constant (sec ⁻¹)		Fission Yield (Fractional)		E _β (max.)	%	E _γ	%	Reference
61 Pm	149							0.784	3			
	150	2.7	H	.71312	-4	.21208	-3	2.0 3.0	80 20	0.34 0.40 0.82 1.17	20 20 80 80	NDS
	151	28.4	H	.67796	-5	.23209	-3	1.1	100	0.715	100	NUS
	152	6.0	M	.19254	-2	.38315	-3	2.2	100	2.8	100	NDS*
	153	5.5 5.5	M	.12836 .21005	-2	.165206	-2					
	154	2.5 3	M	.66508 .46210	-2	.69167	-3	1.25	100	1.25	100	NDS*
	151	80	Y	.27456	-9	0		0.053 0.075	1 99	0.0216	1	NUS
	153	47	H	.40966	-5	.6032	-4	0.64 0.698 0.803	38 40 22	0.0697 0.1032 0.538	38 78 10	NUS
	155	24	M	.48135	-3	.32353	-3	1.50 1.65	7 93	0.105 0.246	93 7	NUS
	156	10	H	.19254	-4	.13358	-3	0.9	100	0	0	NUS
63 Eu	155	1.7	Y	.12920	-7	.2490	-5	0.15 0.16 0.19 0.25	30 40 <10 20	0.060 0.019 <0.45 0.105 0.27 0.87	<10 30 30 40 40	NUS
	156	15.4	D	.52095	-6	.7380	-5	0.5 2.4	60 40	2.0	60	NDS

Nuclide	Mass No.	Half-life		Decay Constant (sec ⁻¹)		Fission Yield (Fractional)		E _{β} (max.)	%	E _{γ}	%	Reference
64 Gd	157	15.0	H	.12836	-4	.7719	-4	1.0	75	0.2	100	NUS
								1.7	25	0.6	100	
	158	60	M	.19254	-3	.1975	-4	1.3	100	1.3	100	NDS*
	160	70	S	.99021	-2	.2800	-5					
	159	18.0	H	.10697	-4	.1047	-4	0.59	20	0.058	6.6	NUS
								0.89	6	0.079	0.6	
								0.948	74	0.225	0.6	
										0.362	19	
	161	3.7	M	.31223	-2	.7300	-6	1.44	4	0.0566	71.9	NDS
								1.54	5	0.0776	8.5	
65 Tb	160	73	D	.10990	-6	.2000	-7	1.60	91	0.102	23.6	
										0.106	1.2	
										0.134	1.3	
										0.165	0.43	
										0.181	2.5	
										0.259	1.8	
										0.273	1.2	
										0.284	7.3	
										0.315	21	
										0.361	60	
										0.482	0.2	
										0.531	1.6	
								0.3	12	0.087	10	NDS, SHS
65 Tb								0.46	19	0.092	?	
								0.56	38	0.1967	8	
								0.76	11	0.216	8	
								0.86	20	0.298	30	
								1.71	0.4	0.40	3	
										0.74	?	
										0.77	?	
										0.876	33	

Nuclide	Mass No.	Half-life		Decay Constant (sec ⁻¹)		Fission Yield (Fractional)		E _β (max.)	%	E _γ	%	Reference
65 Tb	160									0.964	35	NDS
										1.18	16	
	161	6.8	D	.11798	-5	.3000	-7	0.41	17	0.0257		
								0.46	11	0.0487		
								0.49	12	0.0571		
								0.54	60	0.0745		