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RESEARCH GROUP

Report

FISSION PRODUCT CHAIN YIELDS FROM EXPERIMENTS IN REACTORS AND ACCELERATORS PRODUCING FAST NEUTRONS OF ENERGIES UP TO 14 MeV

E. A. C. CROUCH

The contents of this paper have been examined

and recommended by the

United Kingdom Chemical Nuclear Data Committee

Chemistry Division,

Atomic Energy Research Establishment,

Harwell, Berkshire.

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by

E. A. C. Crouch

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ABSTRACT

Published values of the yields of fission products from reactor fast neutron fission of ^{232}Th, ^{233}U, ^{235}U, ^{237}Np, ^{238}U and ^{239}Pu; from the 14 MeV neutron induced fission of ^{231}Pa, ^{232}Th, ^{233}U, ^{235}U, ^{237}Np, ^{238}U, ^{239}Pu and ^{241}Pu, and from the fission of ^{231}Pa, ^{232}Th, ^{235}T, ^{237}Np, ^{238}U and ^{239}Pu induced by neutrons of intermediate energies, have been assessed and recommended values for the chain yields listed. Very few predicted or interpolated values of fission product yields are included, but this compilation is part of the experimental basis for the construction of complete sets of adjusted yields to be published later.

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HARWELL

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TABLES

1. Introduction

This assessment of fission product chain yields from fission induced by neutrons of energies above thermal and up to 14 MeV, is really a continuation of the thermal neutron fission yields assessment (Ref. 1), and the reasons for the work are the same. Briefly, it is hoped it will be possible to assess future published fission product yields together with those already recorded, by means of suitable computer programmes.

As in the case of thermal yields, there are gaps in the experimentally determined chain yields for fast fission, much wider gaps. Only about 50% of the chain yields for the mass range 70 - 170, in fast fission of ^{235}U have been experimentally determined and none at all for the fast fission of ^{240}Pu which will be a major component of fast reactor fuels. There is however, a need for complete sets of fission yields since designers and operators of nuclear reactors must have estimates of parameters which are undetermined experimentally. This paper contains a few interpolated chain yield estimates but not enough for design purposes and based on simple linear interpolation in regions removed from fine structure. The assessed yields of this work together with assessed thermal neutron induced fission product yields (Ref. 1), will be made the basis of the construction of complete sets of fission product chain yields from particular nuclear reactions, adjusted to conform with the basic physical conservation laws.

It is difficult in work of this kind to avoid errors, and the author will be extremely grateful if readers will draw his attention to any errors they may find.

2. Basis of Assessment

(i) The definitions of 'Independent', 'Cumulative' and 'Chain' yields as used in this work have been given before (Ref. 1).

(ii) Treatment of the published results; yield adjustments

The published data for this assessment were stored in a computer file and for each fissile isotope an interrogation routine caused all cumulative and chain yields to be printed out (Ref. 2,3). It was assumed that the printed list contained no duplicate values because during compilation of the library only experimental results, not assessed values, were included. All entries were checked to ensure that values previously reported by the same author(s) were omitted if the new entry were a recalculation of the previous work and not a new determination. The interrogation programme produced a printed output (Ref. 3), containing the published results for one particular reaction and these were used to hand calculate the corrections if any.

As previously explained (Ref. 1,2), there are three ways of classifying fission product yields depending on what corrections or adjustment have to be made to them before they can be consistently combined with other similar results to give an average value. 'One-nuclide' yields are those yields relative to ^{140}Ba or ^{99}Mo etc; then if the reference yield is known the others can be adjusted to it.

'Other' yields (i.e. other than 'one-nuclide' or (see below) 'R-value'), are yields which have been determined absolutely or effectively absolutely, and which do not require or are not amenable to adjustment. In some cases the absolute number of fissions will have been measured corresponding to the absolute determination of the fission products formed; in other cases the yields will be effectively absolute because after measurement of the relative yields of a sufficient number of fission products a curve has been drawn of fission yield versus mass-number and the yields will have been multiplied by a factor which forces the area under the curve to 200%.

'R-value' yields are calculated as follows:

$$y_1^X = y_2^X \left[\frac{A_1^X A_2^R}{A_2^X A_1^R} \right] \frac{y_1^R}{y_2^R}$$

where y is a yield and A an activity

X refers to the nuclide of interest

R refers to the reference nuclide, usually ^{99}Mo

1 refers to the nuclear reaction of interest

2 refers to the reference nuclear reaction, thermal fission usually of ^{235}U, sometimes of ^{239}Pu.

The term in brackets in the above expression is called an 'R-value' and is made up of measured radioactivities derived from the reaction of interest and from a simultaneous standard reaction irradiation. The other components of the right hand side in the equation must be absolutely determined or assumed. For each fissile element the assessment process started with the assembly of all 'Other' fission yields. Mean values for the reference nuclide (e.g. ^{140}Ba, ^{99}Mo and ^{97}Zr), were calculated, and all the 'one-nuclide' results were corrected. Finally the 'R-value' results were adjusted using the results of Ref. (1) as standard reaction yields. Finally the mean value for all the results from a given reaction at a given mass number was calculated including in this the recommended value, all those cumulative yields eligible (see

later), for inclusion as chain yields. Where the number of results for a given reaction is too small for the above procedure to be applied, those results available are given in the tables of results along with values of the reference yields used.

(iii) Treatment of published results: Error estimates

The uncertainties to be associated with a given measurement are reported by the authors in a variety of ways, and frequently not at all. Usually a mean value is given together with limits expressed as yield X ± x, where x may be a standard deviation corresponding to the precision of the measurement only, not to the absolute accuracy of the measurement.

In this work two methods of expressing the experimental uncertainty or 'error' (the word being used in no pejorative sense) were used. In the first method the error (considered as a standard error) used in this paper (as opposed to the figure reported by the author) has been adjusted if necessary to what seemed to be a reasonable estimate of the absolute accuracy. Thus a yield given in an original paper as being subject to an error of ± 0.1% of the mean value, has been attributed a much larger error even if the yield were determined by mass-spectrometry. For this purpose no reported yield has been attributed a standard error of less than ± 3% of the mean value unless very good reason was shown in the paper. Likewise a yield reported without an estimate of its accuracy was attributed a standard error of ± 15% if the yield was determined radioachemically and ± 10% if by mass-spectrometry. There were occasions when better accuracy was attributed because there seemed good cause. Of course in those cases where reasonable errors were attributed to their results by the authors themselves, they were used unchanged.

The weighted mean of all the reported yields (after adjustment) for a given mass number in a given fission reaction was then calculated using the reciprocal of the square of the attributed standard error as weight for each result, together with the standard error of the weighted mean as follows:-

$$\text{Weighted mean yield} = \sum\left(\frac{Y_n}{S_n^2}\right) \Big/ \sum\left(\frac{1}{S_n^2}\right)$$

where Y_n is the nth yield and S_n is its attributed standard error.

$$\text{Standard error of the weighted mean yield} = \left[\sum\left(\frac{1}{S_n^2}\right)\right]^{-\frac{1}{2}}.$$

The weighted sum of squares of the deviations of each included yield from the weighted mean (which should be distributed as χ^2) was then calculated,

$$\sum \left[\frac{Y_n - \bar{Y}_w}{S_n} \right]^2$$

where $\bar{Y}_w$ is the weighted mean yield. If in fact it was significantly different from χ^2 then either the fission yields were inconsistent or the attributed errors were unrealistically small. An extraordinary result was easily indicated by its contribution to this sum and its weight adjusted appropriately rather than reject it outright.

The second method of expressing the experimental uncertainty was simply to use the reported yields for a given mass number after adjustment, to calculate a simple mean and standard deviation directly. These two figures should agree with the weighted values found as described above. If they agreed then the attributed errors were realistic and the yields consistent, but if they differed then either the yields were inconsistent or the attributed errors were smaller than the errors indicated by the variations about the simple mean. It was also possible to find the attributed error larger than that calculated from the simple mean in cases whose only two or three reported results fortuitously agreed closely, although it was known that the experimental method was subject to larger error.

Finally the weighted mean yield was taken as the required assessed yield and the uncertainty (expressed as a standard error) was taken as the greater of the standard error of the weighted mean yield (see above), or the simple standard error calculated as

$$\left[\frac{\sum_i^n (Y_i - \bar{Y})^2}{(n-1)} \right]^{\frac{1}{2}} \Big/ n^{\frac{1}{2}}$$

where $\bar{Y}$ is the simple mean yield.

3. The Assessed Yields

The assessed yields are set out in Tables 1 - 22, and the list of references on which the table reference numbers are based is given in Table 23. Table 23 is in fact the same table as Table 16 (Ref. 1). The experimental results which constitute the basis of Tables 1 - 22 have been obtained from reactions conducted in accelerators producing neutrons of known energy up to 14 MeV, and in nuclear reactors under conditions which give rise to what is commonly called "fast neutron fission".

Taking first reactions conducted in accelerators it is usually true that the neutrons are not uniformly of the nominal energy; there appears always to be some energy distribution great or small about which authors are not very explicit. However, as fission yields do not appear to vary very quickly with neutron energy in the few MeV region perhaps this is not important. Failure to take precautions against fissions caused by neutrons which have been moderated by the surroundings may not be unimportant and if the reader is interested in such possible effects he should consult the original literature.

In the case of "fast fission" in nuclear reactors the results have been mainly obtained in a few fast reactors the neutron energy distribution in which are probably well known. Typically the energy distribution peaks at $\sim$ 400 keV and there are very few neutrons of energy less than 10 keV. Some of the results have been obtained by irradiations in thermal reactors usually inside hollow fuel elements and shielded from thermal neutrons by capsules made of materials which strongly capture them.

The assessed "fast fission" yields are based on results from all these sources and thus it is possible that the calculated errors may include some real variation due to neutron energy difference. However, the author feels justified in combining the results in the "fast fission" tables on the evidence afforded by two papers (Ref. 4,5) the results of which were not included in the Fission Product Library at the beginning of this work, but they have been included in Tables 9, 16 and 19.

In Ref. (4) it is shown experimentally that ratios to ^{140}Ba of ^{95}Zr, ^{103}Ru and ^{131}I do not vary in irradiations made at various positions in the Argonne ZPR-3 reactor, but the ratios differ for ^{103}Ru and ^{131}I, from those found at thermal energies. It is asserted that the absolute yields of ^{140}Ba in ^{235}U and ^{239}Pu fast fission differ from the thermal yields by less than 2% and thus all the observed differences between thermal and fast yields must occur at energies below those found in ZPR-3 (said to be between 150 and 450 keV).

The assessments of Ref. (1) and this work do not support the assertion that ^{140}Ba absolute yields from ^{235}U and ^{239}Pu fission change less than 2% between thermal and fast fission. However it is found that ^{95}Zr absolute yields are virtually the same in thermal and fast fission of ^{235}U and ^{239}Pu so that the argument is still valid. No variation is found in the ratios to ^{95}Zr of ^{103}Ru, ^{131}I and ^{140}Ba across the ZPR-3 reactor, but it is known on the basis of Ref. (1) and this work that the ratios change between "thermal" and "fast" fission. Thus all the variation occurs at neutron energies less than those found in the ZPR-3 reactor.

Note that the tables show yields which are determined as chain-yields and also cumulative yields which can be taken as chain-yields because the independent yields of nuclides of the same mass number but greater atomic number, are negligible. An indication of the admissibility of cumulative yields for this purpose may be gleamed from Ref. (6) which tabulates independent yields. In general no cumulative yields have been used unless they account for 99.00% of the chain yield as calculated in Ref. (6).

4. References

1. E. A. C. Crouch. "Fission product chain yields from experiments in thermal reactors", AERE - R 7209, Jan. 1973 and IAEA/SM-170/94, "Proceedings of the IAEA Symposium on Applications of Neutron Data in Science and Technology", Paris, March 1973.

2. E. A. C. Crouch. "A library of neutron induced fission product yields maintained and interrogated by computer methods. Part 1. Establishment of the library", AERE - R 6642, December 1970.

3. E. A. C. Crouch. "A library of neutron induced fission product yields maintained and interrogated by computer methods. Part 2. Interrogation of the library", AERE - R 7207, August 1972.

4. R. P. Larsen et al. Trans. Am. Nucl. Soc. 14 (1971) p.380.

5. R. P. Larsen et al. Trans. Am. Nucl. Soc. 15 (1972) p.483.

6. E. A. C. Crouch. "Calculated independent yields in thermal reaction fission of ^{233}U, ^{235}U, ^{239}Pu, ^{241}Pu, and in fission of ^{232}Th, ^{238}U and ^{240}Pu", AERE - R 6056, March 1969.

7. N. Holden and F. W. Walker. "Chart of the Nuclides", General Electric Company, Knolls Atomic Power Laboratory, Tenth Edition, December 1968.

5. Explanation of the Tables

Mass Number (Col. 1)

This entry gives the mass-number of the fission product decay chain.

Element (Col. 2)

The symbol of the element used to estimate the chain yield. Several entries in this column does not imply that all were used in the calculation of the chain yield. Chain yields determined as "chain yields" are entered as such. A figure in brackets alongside an element symbol indicates that the nuclide is isomeric and the isomeric yield is given, the number is the order of the isomer in the 'Chart of the Nuclides', Ref. (7).

Literature Reference (Col. 3)

The number given in Column 3 gives the literature reference as set out in Table 23.

Corrected Value and Error (Col. 4)

Column 4 gives the adjusted yield as a percentage followed by the error as a standard deviation expressed as a percentage of the yield. Thus the first entry for Br Table 1 is

to be read "2.58 ± 0.23%". The author's estimates of error are stated when they are given, otherwise an arbitrary default value is inserted (see para. 2(iii) above). If the authors' estimates were considered too low, the value actually used to compute Column 5 entries is given.

Means: Weighted and Simple (Col. 5)

The two figures entered on one line in Column 5 are the mean as a percentage yield, the error as a percentage of the yield. The types of mean are differentiated by (w) for weighted and (s) for simple. Each mean is based on the values given in Column 4 as segregated by the horizontal lines. In some cases, usually when only two results are given in Column 4, the weighted mean only or the simple mean only appears in Column 5. This is because in the former case the weights are not equal and there would be no point in calculating a simple mean, or in the latter case there would be no point in calculating a weighted mean when the weights are equal or nearly so.

In those tables containing results from reactions at various neutron energies, Columns 4 and 5 contain the neutron energy and the reference nuclide yield.

Recommended Chain Yields (Col. 6)

Column 6 lists the recommended chain yield on the same line as the mass-number of the first column. The figures given in brackets are the indicators of yields still undetermined experimentally and they are interpolated values found by curve drawing through the neighbouring points. No attempt has been made to interpolate values when insufficient results are available to draw a smooth curve, or in regions where fine structure is likely to exist.

TABLE 1

^{231}Pa 3.0 MeV Neutron Induced Fission

1	2	3	4		5		6	
83	Br	77	2.58	9.0*			2.58	9
84	Br	77	3.91	4.0*			3.91	4
91	Sr	77	5.89	1.5*			5.89	5
97	Zr	77	3.96	3.0*			3.96	5
99	Mo	77	2.57	- *			2.57	*
105	Ru	77	0.24	8.3*			0.24	9
113	Ag	77	0.072	14.0*			0.072	14
129	Sb	77	0.92	5.4*			0.92	6
143	Ce	77	5.2	1.7*			5.2	5
145	Pr	77	3.22	6.0*			3.22	6

*^{99}Mo assumed to be 2.57%

TABLE 2

^{231}Pa 14 MeV Neutron Induced Fission

1	2	3	4		5			6	
84	Br	655	2.78	3.4*				2.78	5
91	Sr	655	5.56	5.4*				5.56	5
93	Y	655	6.63	3.9*				6.63	5
99	Mo	655	3.21	- *				3.21	-
105	Ru	655	1.31	6.2*				1.31	6
112	Ag	655	2.05	7.3*				2.05	8
113	Ag	655	2.46	3.0*				2.46	5
129	Sb	655	0.58	5.0*				0.58	5
131	I	172	3.37	9.5*				3.37	10
132	Te	655	4.88	5.0*	(S)	4.80	5	4.80	5
	I	172	4.72	5.0*					
133	I	172	5.74	5.0*	(S)	5.97	5	5.97	5
	Xe	172	6.20	5.0*					
134	I	172	9.18	5.0*				9.18	5
135	Xe	172	6.80	6.0*				6.80	6
143	Ce	655	3.35	4.0*				3.35	5

*^{99}Mo assumed to be 3.21%

TABLE 3

^{232}Th Fast Neutron Induced Fission*

1	2	3	4		5			6	
83	Kr(2)	241	2.00	10	(S)	2.03	7	2.03	7
	Chain	369	2.06	10					
84	Kr	241	3.65	10	(S)	3.72	7	3.72	7
	Chain	369	3.78	10					
85	Kr	241	3.88	10	(S)	3.95	7	3.95	7
	Chain	369	4.07	10					
86	Kr	241	6.00	10	(S)	6.11	7	6.11	7
	Chain	369	6.21	10					
87	Chain	369	6.57	10				6.57	10
88	Chain	369	6.92	10				6.92	10
90	Sr	389	6.99	5				6.99	5
99	Mo	-	2.78	-*				2.78	-
131	I	389	2.13	5	(W)	1.87	4.5	1.87	11
	Xe	241	1.62	10	(S)	1.77	11		
	Chain	369	1.56	10					
132	Xe	241	2.87	10	(S)	2.82	7	2.82	7
	Chain	369	2.76	10					
133	Chain	369	3.75	10				3.75	10
134	Xe	241	5.78	10	(S)	5.48	7	5.48	7
	Chain	369	5.18	10					
135	Chain	369	4.66	10				4.66	10
136	Xe	241	5.65	10	(S)	5.55	7	5.55	7
	Chain	369	5.44	10					
137	Cs	389	6.59	5	(W)	5.92	5	5.92	18
	Chain	369	4.60	10	(S)	5.60	18		
139	Chain	369	7.00	10				7.00	10
140	Ba	389	7.72	5				7.72	5
141	Ce	389	7.26	5				7.26	5
143	Chain	369	6.79	10				6.79	10
144	Ce	389	7.98	5				7.98	5
145	Chain	369	5.52	10				5.52	10
146	Chain	369	4.73	10				4.73	10
148	Chain	369	2.08	10				2.08	10
150	Chain	369	1.04	10				1.04	10

*All results were found using ^{99}Mo = 2.78%

TABLE 4

^{232}Th 3.0 MeV Neutron Induced Fission*

1	2	3	4		5		6	
77	As	642	0.01	50			0.01	50
78	As	642	0.036	10			0.036	10
79	As	642	0.075	10			0.075	10
81	Se	642	0.5	10			0.5	10
83	Br	630	2.13	10			2.13	10
84	Br	630	3.23	10			3.23	10
91	Sr	51	6.19	10	(S)	6.55 7	6.55	7
	Y	642	6.90	10				
92	Sr	51	6.40	10			6.40	10
93	Y	642	7.35	9			7.35	9
97	Zr	630	5.35	10			5.35	10
113	Ag	51	0.0455	19			0.0455	19
129	Sb	630	0.160	10			0.160	10
131	I	51	1.11	12			1.11	12
132	Te	630	3.37	10	(S)	2.90 7	2.90	7
	I	51	2.42	8				
133	I	51	3.15	10			3.15	10
134	I	51	7.89	11			7.89	11
135	I	51	5.39	11			5.39	11
139	Ba	51	6.56	7.5			6.56	8
141	Ce	642	6.60	11			6.60	11
143	Ce	630	6.69	10	(S)	6.35 7	6.35	7
		642	6.00	10				
145	Pr	630	5.33	10	(S)	5.02 7	5.02	7
		642	4.70	11				
147	Nd	642	2.20	10			2.20	10
149	Pm	642	1.00	10			1.00	10
151	Pm	642	0.1	20			0.1	20
153	Sm	642	0.03	13			0.03	13
156	Sm	642	0.0013	38			0.0013	40

*^{99}Mo assumed = 3.00% for all values

TABLE 5

^{232}Th 11 MeV Neutron Induced Fission*

1	2	3	4		5	6	
77	Ge(2)	622	2.2	20		-	
91	Sr	622	5.60	20		5.60	20
97	Zr	622	4.95	20		4.95	20
99	Mo	622	3.10	20		3.10	20

TABLE 5 (cont'd)

1	2	3	4		5	6	
103	Ru	622	0.51	50		0.51	50
106	Ru	622	0.53	20		0.53	20
111	Ag	622	0.63	20		0.63	20
115	Cd(2)	622	0.76	20		-	
117	Cd(2)	622	0.37	50		-	
131	I	622	2.30	20		2.30	20
132	Te	622	1.80	50		1.80	50
139	Ba	622	9.0	20		9.0	20
144	Ce	622	7.2	20		7.2	20

*^{89}Sr assumed to be = 0.70% for all values

TABLE 6

^{232}Th 14 MeV Neutron Induced Fission

1	2	3	4		5		6	
66	Ni	352	0.000131	10			0.000131	10
67	Cu	352	0.00026	23			0.00026	23
72	Zn	352	0.0070	8.6			0.0070	8.6
73	Ga	595	0.0076	25			0.0076	25
77	Ge(2)	595	0.067	28			0.124	15
	As	595	0.124	15				
78	Ge	595	0.105	27			0.295	16
	As(2)	595	0.295	16				
79	As	595	0.903	16			0.903	16
81	Se(2)	595	1.15	17			1.15	17
83	Br	357	1.45	22	(W)	1.60 8.5	1.60	8.5
		358	1.60	18	(S)	1.56 4		
		629	1.64	10				
84	Br	357	1.86	6.5	(W)	2.08 4	2.08	4
		629	2.34	5				
85	Kr(1)	664	4.11	10			-	
88	Kr	664	4.28	10			4.28	10
89	Sr	358	5.70	14	(W)	5.81 7	5.81	7
		50	5.85	8				
90	Sr	50	5.54	14			5.54	14
91	Sr	357	6.50	10	(W)	5.50 6	5.50	7
		50	5.35	10	(S)	5.47 7		
		664	4.81	15				
	Y	358	5.20	15				
92	Sr	50	5.41	9.5			5.41	10

TABLE 6 (cont'd)

1	2	3	4		5			6	
93	Y	352	5.30	9.4	(W)	5.60	6	5.60	6
		357	5.80	7					
95	Zr	358	6.70	22				6.70	22
97	Zr	357	3.80	15	(S)	3.32	11	3.32	11
		629	2.84	15					
99	Mo	357	1.84	5	(W)	1.90	4	1.90	4
		358	2.00	10	(S)	1.95	3		
		359	2.00	7					
101	Mo	617	1.52	13				1.52	13
102	Mo	617	0.67	21				0.67	21
103	Ru	359	0.75	17	(W)	0.794	5.5	0.794	6
		362	0.79	6	(S)	0.803	4.5		
		664	0.87	15					
105	Ru	357	1.21	8.3	(W)	1.02	5.5	1.02	9
		359	0.92	11	(S)	1.03	9		
		362	0.95	9					
106	Ru	359	1.07	9				1.07	9
109	Pd	359	1.10	9	(W)	1.14	7.5	1.14	7.5
		362	1.22	12					
111	Ag	357	1.50	13	(W)	1.22	4.5	1.22	7
		358	1.27	12	(S)	1.30	7		
		359	1.50	10					
		50	1.10	10					
		362	1.15	7					
112	Pd	362	1.25	6	(W)	1.29	4.5	1.29	9
		664	1.75	15	(S)	1.39	9		
	Ag	357	1.29	7.8					
		50	1.28	13					
113	Ag	357	1.26	5.5	(W)	1.18	3.5	1.18	4
		359	1.20	8	(S)	1.18	4		
		50	1.06	7.3					
		362	1.20	6					
115	Cd(2)	358	1.07	11	(W)	1.11	7	1.37	10
		362	1.14	8					
	Ag	359	1.24	16	(W)	1.37	10		
		50	1.67	29					
	Chain	266	1.43	13					
121	Sn	264	0.95	10	0	0.915	7	0.915	7
		362	0.88	10					
125	Sn	264	0.55	17	(W)	0.50	7.5	0.50	8
		362	0.49	8					

TABLE 6 (cont'd)

1	2	3	4		5			6	
127	Sb	264	1.15	17	(S)	1.14	11	-	
		664	1.14	15					
129	Sb	357	1.19	7.6	(S)	1.05	5	-	
		629	0.90	7					
	Te	358	0.73	21	(W)	1.31	6.5		
		264	1.52	6					
131	I	50	1.54	13	(W)	2.05	6	2.05	13
		629	2.37	7	(S)	2.03	13		
		664	2.18	15					
132	Te	357	3.05	6.6	(W)	2.78	4	2.78	8
		358	2.80	21	(S)	2.89	8		
		264	2.09	9					
	I	50	3.00	5					
		664	3.49	15					
133	I	50	3.66	5	(W)	3.79	5	3.79	5
		664	5.07	15					
134	I	50	6.49	5.4				6.49	6
135	I	50	4.59	5				4.59	5
139	Ba	50	5.18	7	(W)	5.64	4.5	5.64	5
		357	6.02	5.5					
140	Ba	50	5.79	6	(S)	5.80	4.5	5.80	5
		362	5.80	6					
141	Ce	358	5.90	14				5.90	14
143	Ce	357	5.44	7.5	(W)	5.25	7	5.25	7
		664	4.68	15					
144	Pr	629	2.31	10				2.31	10
147	Nd	352	1.81	7.2				1.81	8
153	Sm	352	0.086	10.5				0.086	11
159	Gd	352	0.0044	9.1				0.0044	10
161	Tb	352	0.0016	5.7				.0016	6
166	Dy	352	0.000029	7				.000029	7
169	Er	352	0.000023	35				.000023	35

TABLE 7

^{233}U Fast Neutron Induced Fission

1	2	3	4		5		6	
89	Sr	62	6.3	5	(W) 6.25	5	6.25	5
		30	5.88	15				
91	Y	30	6.59	15			6.59	15
99	Mo	62	4.75	7.4			4.75	8
103	Ru	62	0.413	11	(W) .633	6.8	.633	55
		44*	1.40	6	(S) .907	55		
106	Ru	62	0.16	12.5	(W) .155	6	.155	6
		44*	0.154	6				
111	Ag	62	.0847	9.4	(W) .0322	10.5	.322	40
		30	0.116	15	(S) .0727	40		
		61	.0174	21				
115	Cd(2)	62	.052	11.5	(S) .0546	45	.056	11
		30	.098	15				
		61	.014	10				
	Chain	62	.056	10.7				
118	Sn	247	0.06$^{\phi}$	10			0.06	10
119	Sn	247	0.074$^{\phi}$	12			0.074	12
120	Sn	247	0.083$^{\phi}$	11			0.083	11
122	Sn	247	0.083$^{\phi}$	11			0.083	11
124	Sn	247	0.12$^{\phi}$	10			0.12	10
126	Sn	247	0.286$^{\phi}$	10			0.286	10
129	Te(1)	62	0.602	8.3			1.57	15
	Chain	62	1.57	15				
132	Te	62	4.36	9.2	(W) 4.50	8	-	
		30	4.96	15				
137	Cs	62	6.28	8	(W) 6.60	5	6.60	5
		44	6.82*	6				
140	Ba	62	6.31	7.92			6.31	8
141	Ce	62	6.77	8.9	(W) 6.54	8	6.54	8
		30	6.01	15				
143	Pr	30	4.83	15			4.83	15
144	Ce	330	3.94	15			3.94	15
147	Nd	30	1.59	15			1.59	15
149	Pm	30	0.747	15			0.75	15
151	Pm	30	0.32	15			0.32	15
153	Sm	30	0.103	15			0.103	15
157	Eu	30	0.0115	15			0.0115	15
159	Gd	30	0.00172	15			0.00172	15
161	Tb	30	0.000474	15			0.000474	15

*140 chain taken as 5.4%. ϕ117 chain taken as 0.06%.
For R-value results ^{99}Mo taken as 4.75%.

TABLE 8

^{233}U 14 MeV Neutron Induced Fission

1	2	3	4		5		6	
66	Ni	572	0.00077	10			0.00077	10
67	Cu	572	0.0018	10			0.0018	10
72	Zn	572	0.0146	4			0.0146	10
83	Br	73	1.33*	6			1.33	6
84	Br	73	2.02*	5			2.02	5
89	Sr	73	4.82*	10			4.82	10
91	Sr	73	5.62*	5	(W) 5.41	5	5.41	5
		665	4.2$^{\phi}$	15				
92	Sr	73	5.72*	6.5			5.72	7
93	Y	572	6.00	10			6.00	10
95	Zr	572	5.60	3.6			5.60	5
97	Zr	572	5.20	5.8			5.20	6
99	Mo	63	3.50	10	(W) 3.69	5	3.69	5
		572	4.10	10	(S) 3.75	5		
		73	3.64*	6				
103	Ru	63	2.31	13			2.31	13
105	Rh	572	2.20	10	(W) 1.88	8	1.88	15
	Ru	73	1.63	12	(S) 1.92	15		
106	Ru	63	1.52	13			1.52	13
109	Pd	73	1.20	10			1.20	10
111	Ag	63	1.22	10	(W) 1.27	7	1.27	15
		572	1.85	16	(S) 1.43	15		
		73	1.21*	12				
112	Pd	572	1.90	5.8	(W) 1.46	5	1.46	17
		665	1.80$^{\phi}$	15	(S) 1.59	17		
	Ag	73	1.08*	9				
113	Ag	73	1.06*	12			1.06	12
115	Ag	73	1.03*	10	1.03	10	1.31	9
	Cd(1)	572	0.138	11	(W) 1.31	9		
	Cd(2)	63	0.98	18				
		572	1.56	10				
	Chain	63	1.05	10				
121	Sn(2)	73	1.06*	7			1.06	10
125	Sn	73	1.51*	6			1.51	10
127	Sb	73	2.20*	6	2.10	6	2.10	12
		665	1.73$^{\phi}$	15	1.97	12		
131	I	73	3.40*	7.4			3.4	10

TABLE 8 (cont'd)

1	2	3	4		5		6	
132	Te	63	3.98	10	(W) 3.82	6	3.82	6
		572	3.50	12	(S) 3.78	3		
	I	73	3.95*	8				
		665	3.70$^{\phi}$	15				
133	I	73	4.63*	7	(W) 4.37	6.5	4.37	7
		665	4.44$^{\phi}$	15				
134	I	73	4.65*	5			4.65	5
135	I	73	4.96*	7			4.96	7
137	Cs	63	4.70	10			4.70	10
139	Ba	73	5.79*	4			5.79	5
140	La	665	5.65$^{\phi}$	15	(W) 4.37	5	4.37	5
	Ba	572	4.30	4.7				
141	Ce	63	5.00	10	(W) 4.70	7	4.70	7
	Ce	572	4.50	9				
143	Ce	572	3.60	6			3.60	6
144	Ce	572	2.60	12			2.60	12
147	Nd	572	1.29	7			1.29	7
153	Sm	572	0.156	8.3			0.156	9
159	Gd	572	0.0116	10			0.0116	10
161	Tb	572	0.005	6			0.005	6
166	Dy	572	0.00026	12			–	
169	Er	572	$0.0_{4}91$	7			–	
172	Er	572	0.0411	14			–	
175	Yb	572	$0.0_{5}21$	14			–	

*Assuming 140 mass chain yield = 5.6%
$^{\phi}$Assuming ^{97}Zr yield = 4.5%

TABLE 9

^{235}U Fast Neutron Induced Fission

1	2	3	4		5		6	
83	Chain	248	0.615	30			0.615	30
84	Chain	248	1.07	3			1.07	3
85	Rb	420	1.34	5	(W) 1.41	3.5	1.41	5
		420	1.30	5	(S) 1.38	4.5		
	Chain	248	1.49	3				
86	Chain	248	1.93	3			1.93	3
87	Rb	420	2.41	5	(W) 2.54	2.5	2.54	4
		420	2.38	5	(S) 2.48	4		
	Chain	248	2.66	3				

TABLE 9 (cont'd)

1	2	3	4		5		6	
88	Chain	248	3.63	3			3.63	3
89	Sr	1	5.60	10	(W) 4.39	3	4.39	6
		164	4.40	9	(S) 4.55	6		
		415	4.22	5				
		633	4.49	5				
		106	4.02	10				
90	Sr	6	5.02	10	(W) 5.10	3	5.10	3
		173	5.51	5	(S) 5.14	3		
		415	4.83	6				
		633	4.84	6				
	Chain	284	5.48	10				
95	Zr	1	7.70	8	(W) 6.44	1.5	6.44	2.5
		164	5.85	9	(S) 6.51	2.5		
		415	6.24	5				
		633	6.45	8				
		633	6.56	12				
		*	6.41	3.5				
		*	6.50	3.5				
		/	6.43	3				
	Chain	248	6.47	3				
97	Zr	164	6.55	11	(W) 5.91	1.6	5.91	2.5
		415	5.93	5	(S) 5.99	2.5		
		633	5.67	10				
		*	5.53	3				
		*	6.13	3				
	Chain	248	6.13	3				
98	Chain	248	6.04	3			6.04	3
99	Mo	1	6.40	6	(W) 5.55	1.3	5.55	2.5
		35	6.10	15	(S) 5.74	2.5		
		164	5.90	7				
		415	5.46	7				
		633	5.33	7				
		*	5.70	3				
		*	5.80	3				
	Chain	409	5.23	7				
100	Chain	248	6.35	3			6.35	3
101	Chain	248	5.46	3			5.46	3
102	Chain	248	4.65	3			4.65	3
103	Ru	164	3.75	15	(W) 3.30	1.75	3.30	5.5
		67	2.82	19	(S) 3.31	5.5		
		*	3.29	3.1				
		*	3.54	3.1				
		/	3.14	3				
104	Chain	248	2.35	3			2.35	3
105	Ru	164	1.45	10			1.45	10

TABLE 9 (cont'd)

1	2	3	4		5			6	
106	Ru	164	1.19	12	(W)	.437	4	.437	27
		67	.626	15	(S)	.665	27		
		420	.425	5					
		423	.423	4					
111	Ag	1	0.031	7	(W)	0.028	3	0.028	11
		164	0.035	20	(S)	0.0345	11		
		415	0.0315	7					
		633	0.0314	7					
		106	0.0482	7					
		195	0.0184	7					
	Chain	248	0.046	5					
112	Chain	248	0.0391	5				0.0391	5
113	Chain	248	0.0342	5				0.0342	5
114	Chain	248	0.0342	5				0.0342	5
115	Cd(1)	164	0.0022	15	(W)	.022	10	0.022	15
		633	0.0049	75	(S)	.026	15		
		195	0.0008	15					
	Cd(11)	164	0.0304	20					
		633	0.0196	20					
		106	0.0309	10					
	Chain	1	0.022	9					
116	Chain	248	0.036	5				0.036	5
125	Chain	248	0.073	12				0.073	12
129	Te	164	0.055	11				0.055	11
130								(1.4)	
131	I	*	3.44	3.1	(W)	3.23	2	3.23	3
		/	3.19	3	(S)	3.26	3		
	Chain	248	3.15	2.5					
132	Te	164	5.35	9	(W)	4.54	3	4.54	6
		633	4.15	8	(S)	4.68	5.5		
		*	4.77	6					
	Chain	248	4.45	4					
133	Cs	420	6.44	5	(W)	6.57	2.5	6.57	3
		420	6.39	5	(S)	6.51	1.5		
	Chain	248	6.69	3					
134	Chain	248	7.09	3				7.09	3
135	Cs	420	6.08	5	(W)	6.26	2.5	6.26	3.5
		420	5.81	5	(S)	6.14	3.5		
	Chain	248	6.54	3					
136	Chain	248	5.93	3				5.93	3

TABLE 9 (cont'd)

1	2	3	4		5			6	
137	Cs	173	6.55	5	(W)	5.99	2.5	5.99	5.5
		238	6.87	10	(S)	5.90	5.5		
		633	4.75	34					
		420	5.67	5					
		420	5.38	5					
	Chain	248	6.20	3					
138	Chain	248	6.60	3				6.60	3
140	Ba	1	6.0	8	(W)	5.78	1.32	5.78	2
		164	5.0	8	(S)	5.76	2		
		415	5.75	5					
		633	5.80	4					
		633	6.01	10					
		678	6.10	5					
		106	5.38	5					
		*	5.67	2.9					
		*	5.69	2.9					
	Chain	248	6.21	3					
141	Ce	164	6.10	10	(W)	5.99	3	5.99	3
		415	5.69	5	(S)	6.05	2.5		
		633	6.40	5					
		633	6.21	7					
	Pr	287	5.85	5					
142	Chain	248	5.82	3				5.82	3
143	Nd	173	5.98	5	(W)	5.80	2.5	5.80	3
		669	5.64	5	(S)	5.81	2		
	Chain	248	5.80	3					
144	Ce	35	4.64	15	(W)	4.94	2	4.94	5
		173	5.22	5	(S)	5.00	5		
		415	5.22	4					
		633	3.52	6					
		633	5.57	8					
		106	4.19	5					
	Nd	420	5.94	5					
		424	5.48	5					
	Chain	248	5.26	3					
145	Nd	173	3.93	5	(W)	3.82	2	3.82	2
		669	3.75	5	(S)	3.81	1		
		420	3.78	5					
		420	3.76	5					
	Chain	248	3.85	3					
146	Nd	173	3.06	5	(W)	-	-	2.96	2
		669	2.89	5	(S)	2.96	2		
		420	2.90	5					
		420	2.90	5					
	Chain	248	3.00	3					

TABLE 9 (cont'd)

1	2	3	4		5		6	
147	Nd	35	2.09	15	(W) 1.99	5	1.99	5
		106	1.98	5				
148	Nd	173	1.75	5	(W) 1.71	2	1.71	2
		669	1.72	5	(S) 1.70	2		
		420	1.66	5				
		420	1.60	5				
	Chain	248	1.75	3				
149	Pm	35	1.04	15	(W) 1.09	3	1.09	3
	Chain	248	1.09	3	(S) 1.07	2.5		
150	Nd	173	0.73	5	(S) 0.72	5	0.72	5
		669	0.722	5				
		420	0.701	5				
		420	0.620	5				
	Chain	248	0.832	5				
151	Chain	248	0.438	3			0.44	3
152	Chain	248	0.309	3			0.309	3
153	Sm	35	0.198	15			0.198	15
154	Chain	248	0.098	3			0.098	3
155	-	-	-				(0.035)	
156	Eu	35	0.0265	15	(W) 0.0151	6	0.0151	20
		633	0.0132	7	(S) 0.0211	20		
		106	0.0236	10				
159	Gd	35	0.0031	15			0.0031	15
161	Gd	35	0.000468	15	(S) 0.0004	20	0.0004	20
	Tb	106	0.000325	15				

*R. P. Larsen et al. Trans. Am. Nucl. Soc. 15 (1972) p.483.
/ibid. 14 (1971) p.370.

TABLE 10

8 MeV Neutron Induced Fission of ^{235}U

1	2	3	4		5	6	
99	Mo	36	5.4	15		5.4	15
111	Ag	202	0.357	5		0.357	5
115	Cd(2)	202	0.239	5		-	
144	Ce	36	3.21	15		3.21	15
147	Nd	36	1.74	15		1.74	15
149	Pm	36	1.00	15		1.00	15
153	Sm	36	0.198	15		0.20	15
156	Eu	36	0.0404	15		0.0404	15
159	Gd	36	0.0057	15		0.0057	15
161	Tb	36	0.00201	15		0.00201	15

TABLE 11

Neutron Induced Fission of ^{235}U at Various Energies

1	2	3	4		5	6
97	Zr	89	5.84	5	(125 keV)	
99	Mo	317	6.10	3	(950 keV)	
		319	5.45	3	(4.85 MeV)	
111	Ag	201	.1306	10	(5 MeV)	
115	Cd(2)	89	0.0075	8	(125 keV)	
		201	0.0891	10	(5 MeV)	
		200	0.0175	10	(1.2 MeV)	
113	Ag	89	.005	20	(65 keV)	
			.0059	13	(125 keV)	
			.0103	20	(200 keV)	
			.0103	13	(305 keV)	
			.0121	12	(540 keV)	
			.0118	12	(1 MeV)	
143	Ce	201	4.72	10	(5 MeV)	

TABLE 12

14 MeV Neutron Induced Fission of ^{235}U

1	2	3	4		5		6	
66	Ni	353	.00028	10	(S) .000345	20	.000345	20
		408	.00041	15				
67	Cu	353	.00065	14			.00065	14
68	-	-	-		-		(.001)	
69	-	-	-		-		(.0016)	
70	-	-	-		-		(.0026)	
71	-	-	-		-		(.004)	
72	Zn	353	.0063	10	(W) .0067	8	.0067	8
		408	.0080	15				
73	-	-	-		-		(.0085)	
74	-	-	-		-		(.017)	
75	-	-	-		-		(.027)	
76	-	-	-		-		(.043)	
77	As	408	.069	15			.069	15
78	-	-	-		-		(.105)	
79	-	-	-		-		(.17)	
80	-	-	-		-		(.255)	
81	Se(1)	408	.052	15			0.362	15
	Se(2)	408	0.31	15				
82	-	-	-		-		(.62)	
83	Ga	408	0.0117	15			0.97	12
	Br	206	1.09	15	(S) 0.97	12		
		408	0.85	15				

TABLE 12 (cont'd)

1	2	3	4		5		6	
84	Br	408	1.05	15			1.05	15
85	-	-	-		-		(1.5)	
86	-	-	-		-		(2.0)	
87	-	-	-		-		(2.7)	
88	-	-	-		-		(3.5)	
89	Sr	165	4.2	10	(S) 4.31	2.1	4.31	5
		206	4.37	10	(W) 4.31	5		
		105	4,14	10				
		284	5.54	10				
90	Sr	5	4.4	10			4.4	10
91	Sr	206	4.89	10	(S) 4.98	2	4.98	7
		284	5.07	10	(W) 4.98	7		
93	Y	353	5.40	10			5.40	10
95	Zr	165	4.30	10	(W) 4.71	7	4.71	9
		284	5.12	10	(S) 4.71	9		
97	Zr	165	4.4	10	(S) 5.24	10	5.24	10
		206	5.21	10				
		284	6.12	10				
99	Mo	165	5.65	10	(S) 5.28	4	5.28	6
		206	5.17	10	(W) 5.28	6		
		625	5.01	10				
103	Ru	165	3.25	9.2	(W) 3.40	7	3.40	7
		206	3.52	10	(S) 3.40	4		
105	Ru	165	2.95	10	(W) 2.12	6	2.12	20
		206	1.94	10	(S) 2.12	20		
		284	1.48	10				
106	Ru	165	2.30	13	(W) 1.75	10	1.75	20
		206	1.59	10	(S) 1.95	20		
109	Pd	206	1.47	10			1.47	10
111	Ag	135	1.05	10	(W) 1.10	5	1.10	5
		206	1.09	10	(S) 1.10	2		
		105	1.09	10				
		284	1.16	10				
112	Pd	206	0.617		(S) 0.89	30	0.89	30
	Ag	284	1.16	10				
113	Ag	94	0.922	11			0.922	11

TABLE 12 (cont'd)

1	2	3	4		5		6	
115	Cd(1)	165	0.06	10	(S) 0.062	4	1.12	20
		105	0.0647	10				
	Cd(2)	165	0.95	10	(S) 1.06	20		
		206	0.82	10				
		105	0.81	10				
		284	1.64	10				
121	Sn	165	1.10	10	(S) 1.025	8	1.025	8
		206	0.95	10				
125	Sn	206	1.91	10			1.91	10
126	Sb	206	3.20	6			3.20	6
127	Sb	206	4.33	10			4.33	10
129	Sb	206	2.28	12			-	
	Te(1)	165	1.58	8			-	
131	I	206	3.89	10	(S) 4.19	4	4.19	4
		284	4.38	10				
		400	4.31	10				
132	Te	165	4.20	10	(S) 4.37	6	4.37	6
		206	4.05	10				
	I	400	4.86	10				
133	I	400	5.56	10			5.56	10
134	I	400	5.14	10			5.14	10
135	I	400	4.55	10			4.55	10
137	Cs	165	5.9	10			5.90	10
139	Ba	206	4.83	10			4.83	10
140	Ba	165	4.2	10	(S) 4.47	5	4.47	5
		206	4.61	10				
		353	4.25	10				
		106	4.75	10				
		284	4.54	10				
141	Ce	165	3.80	10			3.80	10
143	Ce	206	3.81	10	(S) 3.87	5	3.87	7
		105	3.93	10	(W) 3.87	7		
144	Ce	206	3.00	10	(W) 3.09	7	3.09	7
		105	3.18	10	(S) 3.09	3		
147	Nd	353	1.64	10	(S) 1.65	0.5	1.65	7
		105	1.65	10	(W) 1.65	7		
153	Sm	353	0.22	9				
154	-	-	-	-	-	-	(.014)	
155	-	-	-	-	-	-	(.085)	
156	Eu	206	0.061	10	(W) 0.062	7	0.062	7
		105	0.063	10				

TABLE 12 (cont'd)

1	2	3	4		5		6	
157	-	-	-	-	-	-	(.036)	
158	-	-	-	-	-	-	(.022)	
159	Gd	353	0.0127	10			0.0127	10
160	-	-	-	-	-	-	(.0074)	
161	Tb	353	0.0056	10	(S) 0.0051	10	0.0051	10
		105	0.0046	10				
166	Dy	353	0.0028	10			0.0028	10
169	Er	353	0.00008	10			0.00008	10
172	Er	353	0.000018	11			0.000018	11

TABLE 13

Fast Neutron Fission of ^{237}Np*

1	2	3	4		5	6	
93	Y	314	5.97	10		5.97	10
95	Zr	314	5.96	10		5.96	10
97	Zr	314	6.05	10		6.05	10
99	Mo	314	6.90	10		6.90	10
111	Ag	314	0.110	10		0.110	10
115	Cd(2)	314	0.0522	10		-	-
131	I	314	3.20	12		3.20	12
132	Te	314	6.12	10		6.12	10
133	I	314	6.29	12		6.29	12
135	Xe	314	5.52	10		5.52	10
141	Ce	314	6.36	10		6.36	10
143	Ce	314	5.70	10		5.70	10
144	Ce	314	4.54	10		4.54	10
147	Nd	314	2.64	12		2.64	12
149	Pm	314	1.74	12		1.74	12
151	Pm	314	0.88	12		0.88	12
153	Sm	314	0.442	19		0.442	19

*^{140}Ba yield was assumed to be 6.35%

TABLE 14

Fission of ^{237}Np by 1.1 MeV Neutrons*

1	2	3	4		5	6
89	Sr	205	1.30	15	(1.1 MeV)	
97	Zr	205	6.09	15	(1.1 MeV)	
111	Ag	205	0.09	15	(1.1 MeV)	
115	Cd(2)	205	0.033	15	(1.1 MeV)	
125	Sn	205	1.39	15	(1.1 MeV)	
127	Sb	205	0.321	15	(1.1 MeV)	
132	Te	205	4.88	15	(1.1 MeV)	

TABLE 14 (cont'd)

1	2	3	4		5	6
140	Ba	205	5.03	15	(1.1 MeV)	
144	Ce	205	4.04	15	(1.1 MeV)	
156	Eu	205	0.125	15	(1.1 MeV)	

*Yield of ^{99}Mo assumed to be 6.14%

TABLE 15

14 MeV Neutrons Induced Fission of ^{237}Np

1	2	3	4		5	6	
91	Sr	623	2.71	10		2.71	10
93	Y	623	4.94	5		4.94	5
97	Zr	623	5.43	9		5.43	9
99	Mo	623	4.94	4		4.94	4
105	Rh	623	3.50	6		3.50	6
109	Pd	623	1.48	17		1.48	17
111	Ag	623	1.23	4		1.23	4
112	Pd	623	1.23	4		1.23	4
115	Cd(2)	623	1.23	4		-	-
127	Sb	623	2.52	6		2.52	6
131	I	623	3.55	17		3.55	17
132	Te	623	4.29	17		4.29	17
139	Ba	623	4.84	7		4.84	7
140	Ba	623	4.89	7		4.89	7
143	Ce	623	3.60	21		3.60	21
147	Nd	623	1.73	14		1.73	14
153	Sm	623	0.32	8		0.32	8
157	Eu	623	0.094	32		0.094	32

TABLE 16

Fast Neutron Fission of ^{238}U

1	2	3	4		5		6	
77	As	179	.0035	15	(W)	.00361 13	.00361	13
		234	.0040	25				
89	Sr	2	3.7	8.1	(W)	3.16 3.5	3.16	8
		166	4.40	9.1	(S)	3.38 7.5		
		634	3.17	6				
		179	3.23	15				
		234	2.97	11				
		108	2.81	6				
90	Sr	9	3.14	10			3.14	10

TABLE 16 (cont'd)

1	2	3	4		5		6	
95	Zr	2	6.5	9.2	(W) 5.54	3	5.54	6
		166	5.00	10	(S) 5.99	6		
		634	7.35	18				
		179	6.46	15				
		234	5.16	15				
		*	5.47	3.5				
97	Zr	166	5.20	11.5	(W) 5.89	2.6	5.89	5
		634	6.10	6.1	(S) 5.74	5		
		*	5.91	3				
99	Mo	2	6.6	6.1	(W) 6.27	2.5	6.27	3.5
		166	7.0	10	(S) 6.44	3.3		
		634	6.09	13				
		174	5.77	15				
		234	7.03	11				
		*	6.14	3				
103	Ru	166	3.9	13	(W) 6.01	2.93	6.01	13
		179	7.34	15	(S) 6.11	12.6		
		234	6.92	16				
		*	6.26	3.1				
105	Ru	166	3.50	11.4			3.5	12
106	Ru	166	2.65	11	(W) 2.90	8	2.90	9
		234	3.18	10	(S) 2.92	9		
109	Pd	166	0.13	15			0.13	15
111	Ag	2	0.094	8.5	(W) 0.0774	5	0.0774	7
		166	0.094	12.8	(S) 0.0760	7		
		634	0.059	19				
		179	0.070	15				
		234	0.070	8.6				
		108	0.079	8				
112	Pd	166	0.07	15			0.07	15
115	Cd(1)	166	0.003	15	(W) 0.0032	11	0.0407	12
		179	0.0068	15	(S) .00417	32		
		234	0.0027	12				
	Cd(2)	166	0.046	15	(W) 0.0375	7		
		634	0.033	15	(S) 0.0411	12		
		179	0.059	15				
		234	0.035	17				
		108	0.0327	15				
125	Sn	166	0.078	26			0.078	26
127	Sb	166	0.26	12	(W) 0.154	9	0.154	31
		179	0.12	15	(S) 0.173	31		
		234	0.14	23				
129	Te	166	0.26	12			0.26	12
131	I	*	3.62	5			3.62	5

TABLE 16 (cont'd)

1	2	3	4		5		6	
132	Te	166	4.10	10	(W) 4.67	4.2	4.67	7
		634	4.30	8	(S) 4.71	6.3		
		234	5.16	15				
		*	5.27	6				
137	Cs	166	6.10	12	(W) 7.13	7	7.13	7
		634	7.80	22	(S) 7.19	6		
		179	7.04	15				
		234	7.80	10				
140	Ba	2	6.70	7.5	(W) 6.08	2.1	6.08	2.5
		157	6.03	10	(S) 6.17	1.84		
		166	5.80	8.6				
		634	6.30	7				
		680	6.34	6.5				
		108	6.06	8				
		*	5.96	3				
143	Nd	667	5.21	10			5.21	10
144	Ce	234	5.38	10	(W) 4.60	6.5	4.60	10
		37	3.97	15	(S) 4.60	9.5		
		108	4.41	10				
145	Nd	667	4.25	10			4.25	10
146	Nd	667	3.94	10			3.94	10
147	Nd	37	2.48	15	(W) 2.64	9	2.64	9
		108	2.72	10				
148	Nd	667	2.40	8			2.40	8
149	Pm	37	1.78	15			1.78	15
150	Nd	667	1.49	10			1.49	10
153		37	0.43	15			0.43	15
156	Eu	634	0.043	19	(W) 0.0670	6.5	0.067	11
		179	0.063	15	(S) 0.0702	11		
		234	0.080	14				
		37	0.085	15				
		108	0.080	10				
159	Gd	37	0.00828	15			0.00828	15
161	Tb	37	0.00181	15	(S) 0.00149	11	0.00149	11
		108	0.00117	15				

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TABLE 17

Fission of ^{238}U at Various Neutron Energies

1	2	3	4		5	6
77	As	370	.0027	15	(^{99}Mo = 6.20)	(1.5 MeV)
		371	.0035	15	(^{99}Mo = 6.20)	(2.0 MeV)
		372	.0084	15	(^{99}Mo = 6.20)	(3.0 MeV)
		373	.018	15	(^{99}Mo = 6.20)	(3.9 MeV)
		374	.014	15	(^{99}Mo = 6.20)	(4.8 MeV)
		375	.028	15	(^{99}Mo = 6.20)	(13.0 MeV)
		376	.036	15	(^{99}Mo = 6.20)	(15.0 MeV)
		377	.039	15	(^{99}Mo = 6.20)	(16.4 MeV)
		378	.034	15	(^{99}Mo = 6.20)	(17.7 MeV)
91	Chain	411	3.50	5	(^{99}Mo = 6.32)	(3.0 MeV)
93	Chain	411	4.77	5	(^{99}Mo = 6.32)	(3.0 MeV)
99	Mo	38	6.20	15		(8.0 MeV)
		322	6.19	5		(1.55 MeV)
		324	6.45	5		(4.85 MeV)
105	Chain	411	3.81	6	(^{99}Mo = 6.32)	(3.0 MeV)
107	Chain	411	1.36	10	(^{99}Mo = 6.32)	(3.0 MeV)
111	Ag	370	0.021	15	(^{99}Mo = 6.20)	(1.5 MeV)
		371	0.030	15	(^{99}Mo = 6.20)	(2.0 MeV)
		372	0.048	15	(^{99}Mo = 6.20)	(3.0 MeV)
		373	0.086	15	(^{99}Mo = 6.20)	(3.9 MeV)
		374	0.12	15	(^{99}Mo = 6.20)	(4.8 MeV)
		375	0.82	15	(^{99}Mo = 6.20)	(13.0 MeV)
		376	0.96	15	(^{99}Mo = 6.20)	(15.0 MeV)
		377	1.07	15	(^{99}Mo = 6.20)	(16.4 MeV)
		378	0.87	15	(^{99}Mo = 6.20)	(17.7 MeV)
115	Cd(2)	370	0.00074	15	(^{99}Mo = 6.2)	(1.5 MeV)
		371	0.013	15	(^{99}Mo = 6.2)	(2.0 MeV)
		372	0.024	15	(^{99}Mo = 6.2)	(3.0 MeV)
		373	0.045	15	(^{99}Mo = 6.2)	(3.9 MeV)
		374	0.065	15	(^{99}Mo = 6.2)	(4.8 MeV)
		375	0.651	15	(^{99}Mo = 6.2)	(13.0 MeV)
		376	0.95	15	(^{99}Mo = 6.2)	(15.0 MeV)
		377	0.97	15	(^{99}Mo = 6.2)	(16.4 MeV)
		378	0.81	15	(^{99}Mo = 6.2)	(17.7 MeV)
129	Chain	411	0.41	5	(^{99}Mo = 6.32)	(3.0 MeV)
131	Chain	411	3.1	5	(^{99}Mo = 6.32)	(3.0 MeV)
143	Chain	411	5.14	5	(^{99}Mo = 6.32)	(3.0 MeV)
144	Ce	38	3.66	15		(8.0 MeV)
145	Chain	411	4.08	5	(^{99}Mo = 6.32)	(3.0 MeV)
147	Nd	38	2.30	15		(8.0 MeV)
149	Pm	38	1.52	15		(8.0 MeV)
153	Sm	38	0.44	15		(8.0 MeV)
156	Eu	38	0.103	15		(8.0 MeV)
159	Gd	38	0.0155	15		(8.0 MeV)
161	Tb	38	0.00443	15		(8.0 MeV)

TABLE 18

14 MeV Neutron Fission of ^{238}U

1	2	3	4		5			6	
66	Ni	354	0.000085	11				0.000085	11
67	Cu	354	0.00014	30				0.00014	30
72	Zn	354	0.003	13				0.003	13
73	Ga	594	0.005	17				0.005	17
77	Ge	594	0.031	17	(W)	0.0298	8	0.0298	8
	As	376	0.0338	15	(S)	0.0305	6		
		594	0.031	17					
		375	0.026	15					
78	Ge	594	0.041	12	(W)	0.0412	11	0.0412	11
	As	594	0.042	24					
79	As	594	0.19	17				0.19	17
81	Se	594	0.34	15				0.34	15
83	Br	356	0.68	8	(W)	0.722	5	0.722	5
	Chain	368	0.75	6					
84	Br	356	1.33	3	(W)	1.315	2.7	1.315	3
	Chain	368	1.26	6					
85	Kr(1)	666	0.98	15				1.12	5
	Chain	368	1.12	5					
86	Chain	368	1.76	6				1.76	6
88	Kr	666	1.41	15				-	-
89	Sr	81	2.3	5.2	(W)	2.70	3	2.70	7
		167	3.3	9.1	(S)	2.83	7		
		285	3.19	5.5					
		49	2.14	10					
		107	2.99	10					
		207	3.04	5					
90	Sr	8	3.06	3.9	(W)	3.13	4	3.13	4
		49	3.64	8.8					
91	Sr	285	3.77	7.7	(W)	3.14	3.5	3.14	6
		49	2.78	11.5	(S)	3.41	6		
		666	3.78	15					
		685	3.68	7.8					
	Y	81	2.78	5					
	Chain	368	3.66	8					
93	Y	354	4.4	9	(W)	4.14	3.5	4.14	4
		356	4.11	5					
95	Zr	167	4.6	9	(W)	5.31	4	5.31	9
		285	5.4	4.3	(S)	5.40	9		
		659	6.21	9.8					

TABLE 18 (cont'd)

1	2	3	4		5			6	
97	Zr	167	4.9	8.2	(W)	5.49	2	5.49	4
		356	5.97	6	(S)	5.45	4		
		285	5.92	5					
		654	5.54	5					
		654	6.0	8					
		659	4.78	10.6					
		207	5.22	5					
	Chain	368	5.27	8					
99	Mo	81	5.58	10	(W)	5.81	3	5.81	4
		167	6.50	8	(S)	5.90	3.5		
		325	5.68	5					
		356	6.47	10					
		207	5.70	10					
		626	5.86	5					
	Chain	368	5.50	6					
101	Mo	285	5.74	4	(W)	6.02	3.5	6.02	4
		618	6.58	5					
102	Mo	285	4.12	11	(S)	3.54	8	3.54	8
		618	2.95	11					
103	Ru	167	3.0	10	(W)	4.16	4	4.16	11
		354	4.56	5	(S)	4.39	11		
		666	4.86	15					
	Chain	368	5.15	10					
105	Ru	167	3.30	9.1	(W)	2.69	3	2.69	9
		356	2.65	6.1	(S)	2.97	9		
		285	2.26	8					
		364	3.11	5					
		654	2.10	7					
		685	3.78	11.4					
	Rh	207	3.61	7					
106	Ru	167	2.40	13				2.40	13
107	Rh	685	1.78	30				1.78	30
109	Pd	356	1.20	17	(W)	1.52	6	1.52	9
		364	1.59	10	(S)	1.46	9		
		685	1.59	7.5					
111	Pd	356	0.65	12	(W)	0.917	3	0.917	6
	Ag	81	0.81	5	(S)	0.911	6		
		167	1.06	11					
		356	0.98	16					
		285	1.04	6					
		364	1.14	5					
		376	0.89	15					
		49	0.64	17					
		107	0.996	70					
		207	1.05	7					
		375	0.77	15					

TABLE 18 (cont'd)

1	2	3	4		5			6	
112	Pd	167	0.70	15	(W)	0.993	4	0.993	13
		306	0.79	10	(S)	1.012	13		
		364	1.28	5					
		666	1.36	15					
	Ag	285	0.93	6					
113	Ag	356	0.87	7	(W)	0.877	4.5	0.877	7
		354	0.91	6	(S)	0.804	7		
		654	0.70	30					
		654	0.90	17					
		49	0.64	31					
115	Cd(1)	81	0.06	16	(S)	0.0596	8	0.741	7
		167	0.06	15					
		107	0.0588	10					
	Ag(2)	356	0.64	8					
	Cd(2)	81	0.58	5.2	(W)	0.681	3		
		167	0.80	11	(S)	0.744	7		
		285	0.93	6					
		364	0.89	10					
		107	0.663	10					
		207	0.663	7					
		375	0.613	15					
121	Sn(2)	364	1.18	10	(S)	0.97	7	0.97	7
		207	0.76	7					
125	Sn(2)	364	0.88	10	(S)	0.925	7	–	–
		207	1.07	10					
127	Sb	666	1.47	15	(W)	1.415	6	1.42	6
		685	1.57	13	(S)	1.47	4		
		207	1.37	7					
129	Sb	365	1.18	10	(W)	1.26	5.4	1.26	13
		685	1.73	12	(S)	1.38	13		
	Te	167	1.22	7.1					
131	I	356	4.6	9	(W)	3.83	3	3.83	7
		285	5.28	5.5	(S)	4.04	7		
		49	2.89	7.4					
		666	4.53	15					
		685	3.69	17					
	Xe	407	3.50	10					
		648	3.81	5					
	Chain	348	4.02	10					
132	Te	167	4.4	7	(W)	4.68	4	4.68	4
		207	4.58	7	(S)	4.82	3		
	I	49	4.50	8.9					
		666	5.14	15					
	Xe	407	5.04	10					
	Chain	368	4.94	10					

TABLE 18 (cont'd)

1	2	3	4		5		6	
133	I	666	6.83	15	(W) 6.54	4.5	6.54	5
	Xe	356	6.65	5	(S) 6.52	3.5		
	Chain	368	6.08	10				
	I	49	2.78	200	(omitted)			
134	I	49	5.03	30	(omitted)		6.53	4
	Xe	407	7.01	10	(W) 6.53	3.5		
		648	6.45	5	(S) 6.65	3		
	Chain	368	6.50	5				
135	I	49	5.35	10			5.65	5
	Xe	356	5.59	5	(W) 5.65	5		
	Chain	368	5.89	10				
136	Xe	407	6.24	10	(W) 5.64	3.5	5.64	5
		648	5.43	5	(S) 5.80	4.4		
	Chain	368	5.74	5				
137	Cs	167	6.60	9	(S) 5.84	7.5	5.84	8
	Chain	368	5.08	10				
138	Ba	49	4.71	11.4			4.71	12
139	Ba	356	4.92	18	(W) 5.00	7	5.00	7
	Chain	368	5.02	7				
140	Ba	81	4.41	10	(W) 4.67	3	4.67	3
		167	4.90	8	(S) 4.72	2		
		354	4.46	8				
		356	4.67	10				
		235	4.64	5				
		107	4.84	8				
		207	4.70	7				
	La	666	5.34	15				
	Chain	368	4.54	12				
141	Ce	167	5.80	10	(W) 4.77	5.5	4.77	10
		257	4.17	10	(S) 4.93	10		
	Chain	368	4.82	8				
143	Ce	81	3.91	7.2	(W) 3.72	3	3.72	5
		356	3.51	20	(S) 4.01	5		
		257	4.60	11				
		666	3.93	15				
		685	4.74	8				
		107	3.98	5				
	Pr	81	3.16	5				
	Chain	368	4.26	10				
144	Ce	81	2.68	6	(W) 3.21	4	3.21	10
		257	4.28	50	(S) 3.60	9.5		
		107	3.67	5				
		207	3.78	8				
145	Pr	685	3.18	5			3.18	5

TABLE 18 (cont'd)

1	2	3	4		5		6	
147	Nd	81	2.0	5	(W) 2.10	3	2.10	4
		354	2.2	7	(S) 2.17	4		
		107	2.15	5				
	Pm	257	2.46	13				
	Chain	368	2.03	12				
153	Sm	81	0.39	5	(W) 0.40	5	0.40	5
		354	0.42	10				
156	Eu	81	0.13	15	(W) 0.11	5.5	0.11	9
		107	0.098	8	(S) 0.117	8.5		
		207	0.124	8				
159	Gd	354	0.026	12			0.026	12
161	Tb	354	0.0089	6	(S) 0.0083	5	0.0083	5
		107	0.0077	6				
166	Dy		0.00063	10			0.00063	10
169	Er	354	0.00013	7			0.00013	7
172	Er	354	0.000021	35			0.000021	33

TABLE 19

Fast Neutron Fission of ^{239}Pu

1	2	3	4		5		6	
72	Zn	327	0.000074	5			0.000074	5
77	As	160	0.0129	4.8	(W) 0.0134	4.5	0.0134	32
		631	0.0120	13	(S) 0.0181	32		
		632	0.0295	10.2				
78	As	160	0.035	5			0.035	5
83	Br	160	0.314	7.4	(W) 0.36	3	0.36	8
	Chain	249	0.366	3	(S) 0.34	8		
84	Chain	249	0.56	5			0.56	5
85	Chain	249	0.672	5			0.672	5
86	Chain	249	0.882	5			0.882	5
87	Chain	249	1.16	5			1.16	5
88	Chain	249	1.44	5			1.44	5
89	Sr	3	1.80	11	(W) 1.87	5.5	1.87	6
		635	1.88	6.9	(S) 1.86	2		
		161	1.91	10				
90	Sr	12	2.12	4.2	(W) 2.18	2.5	2.18	14
		174	2.01	5	(S) 2.46	14		
		635	3.45	11				
	Chain	249	2.24	3				

TABLE 19 (cont'd)

1	2	3	4		5			6	
91	Chain	249	2.58	5				2.58	5
92	Chain	249	3.13	5				3.13	5
93	Chain	249	3.91	5				3.91	5
94	Chain	249	4.40	5				4.40	5
95	Zr	3	5.30	9.4	(W)	4.84	1.3	4.84	3
		345	5.80	6.4	(S)	5.31	3.3		
		345	5.72	6.1					
		161	5.52	5.1					
		350	5.91	15					
		*	4.77	3.5					
		≠	4.70	1.7					
	Chain	249	4.78	5					
96	Chain	249	5.11	5				5.11	5
97	Zr	635	5.84	6.2	(W)	5.32	2.0	5.32	2.5
		161	5.56	5	(S)	5.46	2.2		
		350	5.49	15					
		631	5.70	6					
		632	5.35	5.8					
		*	4.86	3.5					
	Chain	249	5.47	3					
98	Chain	249	5.81	5				5.81	5
99	Mo	3	5.50	7.3	(W)	5.81	2.5	5.81	3
		64	5.90	10.2	(S)	5.88	2.5		
		635	5.96	5					
		627	5.80	3					
		350	6.23	15					
100	Chain	249	6.76	5				6.76	5
101	Chain	249	6.88	5				6.88	5
102	Chain	249	6.97	5				6.97	5
103	Ru	64	6.0	12	(W)	6.79	1.5	6.79	4.5
		66	6.01	18	(S)	6.46	4.5		
		*	7.05	3.1					
		≠	6.76	1.5					
104	Chain	249	6.77	5				6.77	5
106	Ru	64	4.80	13	(W)	4.82	10	4.82	10
		66	4.85	17					
109	Pd(2)	350	1.80	15				1.80	15
111	Ag	3	0.45	6.7	(S)	0.439	14	0.439	14
		64	0.55	10.9					
		635	0.37	4.9					
		161	0.196	4.3					
		631	0.423	5.2					
		632	0.711	5					
	Chain	249	0.376	3					

TABLE 19 (cont'd)

1	2	3	4		5			6	
112	Pd	327	0.067	5	(S)	0.137	51	0.137	51
	Chain	249	0.207	3					
113	Ag	161	0.05	6.4	(S)	0.0915	45	0.0915	45
	Chain	249	0.133	3					
114	Chain	249	0.099	5				0.099	5
115	Cd(1)	635	0.005	20	ϕ(S)	0.115	66	0.115	70
		631	0.0049	4.1					
		632	0.016	90					
	Cd(2)	3	0.098	8.2					
		64	0.090	11.1					
		635	0.060	5					
		56	0.14	5					
		299	0.0144	6					
		327	0.0188	5					
		631	0.0712	4					
		632	0.219	9.1					
	Chain	64	0.095	10.5					
ϕCalculated from the chain (sum) values									
116	Chain	249	0.064	5				0.064	3
121	Sn(2)	56	0.0169	5	(S)	.0169	3	0.0169	3
		299	0.0169	5					
125	Sn(2)	56	0.061	4	(S)	0.061	4	0.19	11
		299	0.061	3.4					
	Chain	249	0.19	10.5					
129	Te(1)	64	0.45	20				1.17	15
	Chain	64	1.17	15					
131	I	1	4.77	3.1	(W)	4.45	1.5	4.45	5
		≠	4.44	1.5	(S)	4.42	5		
	Chain	249	4.06	5					
132	Te	64	3.5	29	(S)	4.35	20	5.42	5
		635	5.19	6.9					
	Chain	249	5.42	5					
133	Chain	249	6.91	5				6.91	5
134	Chain	249	7.35	5				7.35	5
135	Chain	249	7.54	5				7.54	5
136	Chain	249	6.92	5				6.92	5
137	Cs	174	6.47	5	(W)	6.69	2.5	6.69	10
		239	7.45	5	(S)	6.31	10		
		635	4.74	31					
	Chain	249	6.58	3					
138	Chain	249	4.97	5				4.97	5

TABLE 19 (cont'd)

1	2	3	4		5			6	
139	Ba	631	6.26	7.8	(W)	6.11	5	6.11	5
		632	6.05	5					
140	Ba	3	4.90	8.2	(W)	5.26	1.5	5.26	1.5
		64	5.40	9.3	(S)	5.27	1.5		
		635	5.45	5					
		635	5.53	10					
		627	5.00	3					
		631	5.18	8.5					
		632	5.15	7.7					
		*	5.25	2.9					
	Chain	249	5.59	3					
141	Ce	635	5.88	6	(W)	5.84	3.5	5.84	4
		635	5.76	6.9	(S)	5.68	3		
		161	5.64	6					
		631	5.98	10.4					
		632	5.14	14					
142	Chain	249	4.95	5				4.95	5
143	Ce	161	5.08	5	(W)	4.45	2	4.45	3
		631	4.67	8.1	(S)	4.55	3		
		632	4.48	8.0					
	Nd	174	4.41	5					
		668	4.38	5					
	Chain	249	4.30	3					
144	Ce	174	3.49	5	(W)	3.51	2.5	3.51	10
		635	2.78	6.1	(S)	3.93	9.5		
		635	3.98	8					
		631	4.25	29					
		632	5.37	10					
	Chain	249	3.49	5					
145	Nd	174	3.05	5	(W)	3.05	2.3	3.05	2.5
		668	3.05	5					
	Chain	249	3.04	3					
146	Nd	174	2.53	5	(W)	2.52	2.3	2.52	2.5
		668	2.52	5					
	Chain	249	2.52	3					
148	Nd	174	1.69	5	(W)	1.73	2.5	1.73	2.5
		668	1.74	3.5	(S)	1.72	1		
	Chain	249	1.73	3					
149	Chain	249	1.36	5				1.36	5
150	Nd	174	1.01	5	(W)	1.05	2.5	1.05	2.5
		668	1.06	5	(S)	1.04	2		
	Chain	249	1.06	3					

TABLE 19 (cont'd)

1	2	3	4		5			6	
151	Chain	249	0.84	5				0.84	5
152	Chain	249	0.683	5				0.683	5
153	Sm	350	0.51	15				0.51	15
154	Chain	249	0.324	5				0.324	5
156	Eu	635	0.19	5	(W)	0.159	4.5	0.159	15
		631	0.117	10.2	(S)	0.150	14.5		
		632	0.142	13.4					
157	Eu	631	0.104	8.7	(W)	0.108	4	0.108	4
		632	0.109	3.7	(S)	0.107	2.5		

*R. P. Larsen et al. Trans. Am. Nucl. Soc. 15 (1972) p.483.
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TABLE 20

Fission of ^{239}Pu at Various Energies

1	2	3	4		5	6
111	Ag	95	0.132	20	(^{99}Mo = 6.06)	(30 keV)
		96	0.133	5.2	(^{99}Mo = 6.06)	(60 keV)
		97	0.194	12	(^{99}Mo = 6.06)	(120 keV)
		98	0.174	12	(^{99}Mo = 6.06)	(200 keV)
		99	0.239	12	(^{99}Mo = 6.06)	(300 keV)
		100	0.256	12	(^{99}Mo = 6.06)	(500 keV)
		101	0.220	12	(^{99}Mo = 6.06)	(1 MeV)
		102	0.859	12	(^{99}Mo = 6.06)	(6 MeV)
113	Ag	95	0.0263	37	(^{99}Mo = 6.06)	(30 keV)
		96	0.0342	27	(^{99}Mo = 6.06)	(60 keV)
		97	0.0396	12	(^{99}Mo = 6.06)	(120 keV)
		98	0.0431	12.3	(^{99}Mo = 6.06)	(200 keV)
		99	0.0497	12.2	(^{99}Mo = 6.06)	(300 keV)
		100	0.0528	12	(^{99}Mo = 6.06)	(500 keV)
		101	0.0631	12.7	(^{99}Mo = 6.06)	(1 MeV)
		102	0.269	12	(^{99}Mo = 6.06)	(6 MeV)
115	Cd(2)	52	.0279	4.3	(^{99}Mo = 6.18)	(0.06 eV)
		53	.0143	5.5	(^{99}Mo = 6.18)	(0.22 eV)
		54	.0124	8.4	(^{99}Mo = 6.18)	(0.297 eV)
		55	.0115	4.2	(^{99}Mo = 6.18)	(0.36 eV)
121	Sn(2)	52	.0334	3.8	(^{99}Mo = 6.18)	(0.06 eV)
		53	.0149	10	(^{99}Mo = 6.18)	(0.22 eV)
		54	.0128	8.5	(^{99}Mo = 6.18)	(0.297 eV)
		55	.0131	7.1	(^{99}Mo = 6.18)	(0.36 eV)
125	Sn (2)	52	0.100	3.4	(^{99}Mo = 6.18)	(0.06 eV)
		53	0.0628	9	(^{99}Mo = 6.18)	(0.22 eV)
		54	0.0566	3.3	(^{99}Mo = 6.18)	(0.297 eV)
		55	0.0508	3.3	(^{99}Mo = 6.18)	(0.36 eV)

TABLE 21

14 MeV Neutron Fission of ^{239}Pu

1	2	3	4		5			6	
89	Sr	286	1.83	4.5	(W)	1.72	3.5	1.72	7
		109	1.61	5	(S)	1.72	6.5		
91	Sr	286	2.04	6.1				2.04	6
97	Zr	286	3.99	4.2				3.99	5
99	Mo	65	4.16	9.6				*4.16	10
103	Ru	65	6.25	12.8				6.25	13
106	Ru	65	4.16	12				4.16	12
111	Ag	65	1.46	10.3	(W)	1.55	3.5	1.55	8
		286	1.83	4.5	(S)	1.54	8.0		
		105	1.46	12					
		109	1.39	5					
113	Ag	103	1.09	12				1.09	12
115	Cd(2)	65	1.23	8.1	(W)	1.07	5	1.30	10
		286	1.16	7.2	(S)	1.08	11		
		109	0.86	10					
	Chain	65	1.30	10					
132	Te	65	4.58	11				4.58	11
137	Cs	65	5.10	16				5.10	16
140	Ba	65	4.35	9.2	(W)	2.86	4	2.86	15
		286	2.66	4.7	(S)	3.41	15		
		109	3.22	10					
144	Ce	109	2.17	10				2.17	10
147	Nd	109	1.41	10				1.41	10
156	Eu	109	0.02	10				0.02	10
161	Tb	109	.000138	15				.000138	15

*^{99}Mo = 4.16 was used to correct other results

TABLE 22

14 MeV Neutron Fission of ^{241}Pu*

1	2	3	4		5			6	
115	Cd(2)	57	0.036	10	(S)	0.036	7	-	-
		300	0.036	10					
121	Sn(2)	57	0.0494	10	(S)	0.0499	7	0.0499	7
		300	0.0485	10					
125	Sn(2)	57	0.0417	15	(S)	0.0417	11	0.0417	11
		300	0.0417	15					

*^{99}Mo taken as 6.14%

TABLE 23

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