Summary of JENDL-3.2

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The second revision of JENDL-3 (JENDL-3.2) was released in 1994. The library contains evaluated neutron nuclear data for 340 nuclides which are needed for the design of fission and fusion reactors and for shielding calculation. This report presents the File-1 part of JENDL-3.2 which summarizes the evaluation method for each nuclide.

Keywords: JENDL-3.2, Neutron Nuclear Data, Fission Reactors, Fusion Reactors, Shielding, Evaluation Method, Summary

1. Introduction

The second revision[1)] of JENDL-3, referred to as JENDL-3.2, was released in 1994, and it contains evaluated neutron nuclear data for 340 nuclides in the energy region from 10^{-5} eV to 20 MeV. The JENDL-3.2 data are being used in the various application fields such as fission reactors, fusion reactors, and shielding research.

The official version of JENDL-3.2 was prepared in the ENDF-6 format[2)], although the ENDF-5 format[3)] version is also available. The ENDF-5 format version is consistent with the ENDF-6 format one, because the File-6, which represents angle-dependent energy distributions of emitted particles, was not employed in JENDL-3.2. The JENDL-3.2 data were stored in 15 different files, as given in Table 1.

The graphs and tables of the JENDL-3.2 cross sections were published as JAERI-Data/Code reports[4,5)]. This report presents the File-1 part of JENDL-3.2 which describes how the evaluation was performed for each nuclide, and the report must be helpful for both data users and evaluators.

References

1) Nakagawa T., Shibata K., Chiba S., Fukahori T., Nakajima Y., Kikuchi Y., Kawano T., Kanda Y., Ohsawa T., Matsunobu H., Kawai M., Zukeran A., Watanabe T., Igarasi S., Kosako K. and Asami T.: “Japanese Evaluated Nuclear Data Library Version 3 Revision-2: JENDL-3.2”, J. Nucl. Sci. Technol., **32**, 1259 (1995).
2) McLance V., Dunford C.L. and Rose P.F.: “ENDF 102 Data Formats and Procedures for the Evaluated Nuclear Data File ENDF-6”, BNL-NCS-44945, Rev. 11/95 (1995).
3) Kinsey R.: “ENDF 102 Data Formats and Procedures for the Evaluated Nuclear Data File, ENDF”, BNL-NCS-50496, 2nd Edition (ENDF/B-V) (1979).
4) Shibata K., Nakagawa T., Sugano H. and Kawasaki H.: “Curves and Tables of Neturen Cross Sections in JENDL-3.2”, JAERI-Data/Code 97-003 (1997).
5) Fukahori T., Iwamoto O., Nakagawa T., Shibata K., Narita T., Hasegawa A. and Katakura J.: “JENDL-3.2 Plots and Data (CD-ROM)”, JAERI-Data/Code 97-044 (1997).

Table 1 Nuclides contained in JENDL-3.2 (ENDF-6 format).

Tape No.	No.	Nuclide	MAT No.	Records
301	1	^{1}H	125	286
	3	^{3}He	225	532
	4	^{4}He	228	1276
	5	^{6}Li	325	2445
	6	^{7}Li	328	3534
	7	^{9}Be	425	2732
	8	^{10}B	525	3709
	9	^{11}B	528	5140
	10	^{12}C	625	2614
	11	^{14}N	725	7456
	12	^{15}N	728	3567
	13	^{16}O	825	5664
	14	^{19}F	925	4526
	15	^{23}Na	1125	5227
	16	Mg	1200	4376
	17	^{24}Mg	1225	1604
	18	^{25}Mg	1228	2050
	19	^{26}Mg	1231	1681
	20	^{27}Al	1325	6414
				(Total 65950)
302	1	Si	1400	8169
	2	^{2}8Si	1425	4723
	3	^{29}Si	1428	5781
	4	^{30}Si	1431	448
	5	^{31}P	1525	2330
	6	S	1600	4845
	7	^{32}S	1625	1801
	8	^{33}S	1628	1554
	9	^{34}S	1631	1439
	10	^{36}S	1637	1299
	11	Cl	1700	8013
	12	^{35}Cl	1725	5527

Table 1 (continued)

Tape No.	No.	Nuclide	MAT No.	Records
302	13	^{37}Cl	1731	4758
	14	^{40}Ar	1837	7085
	15	K	1900	3458
	16	^{39}K	1925	1347
	17	^{40}K	1928	1361
	18	^{41}K	1931	1233
				(Total 69208)
303	1	Ca	2000	7731
	2	^{40}Ca	2025	4101
	3	^{42}Ca	2031	2546
	4	^{43}Ca	2034	2603
	5	^{44}Ca	2037	2387
	6	^{46}Ca	2043	2022
	7	^{48}Ca	2049	1582
	8	^{45}Sc	2125	2226
	9	Ti	2200	7385
	10	^{46}Ti	2225	2444
	11	^{47}Ti	2228	2961
	12	^{48}Ti	2231	2900
	13	^{49}Ti	2234	2836
	14	^{50}Ti	2237	2433
	15	^{51}V	2328	3754
	16	Cr	2400	9456
	17	^{50}Cr	2425	2441
	18	^{52}Cr	2431	3372
	19	^{53}Cr	2434	3531
	20	^{54}Cr	2437	2359
	21	^{55}Mn	2525	19006
				(Total 90076)

Table 1 (continued)

Tape No.	No.	Nuclide	MAT No.	Records
304	1	Fe	2600	10692
	2	^{54}Fe	2625	5005
	3	^{56}Fe	2631	6419
	4	^{57}Fe	2634	5235
	5	^{58}Fe	2637	4328
	6	^{59}Co	2725	5540
	7	Ni	2800	10156
	8	^{58}Ni	2825	3936
	9	^{60}Ni	2831	4082
	10	^{61}Ni	2834	2591
	11	^{62}Ni	2837	2684
	12	^{64}Ni	2843	2579
	13	Cu	2900	6480
	14	^{63}Cu	2925	5701
	15	^{65}Cu	2931	5486
				(Total 80914)
305	1	Ga	3100	8454
	2	^{69}Ga	3125	5627
	3	^{71}Ga	3131	5775
	4	Ge	3200	11073
	5	^{70}Ge	3225	4454
	6	^{72}Ge	3231	4674
	7	^{73}Ge	3234	6170
	8	^{74}Ge	3237	4644
	9	^{76}Ge	3243	4541
	10	^{75}As	3325	3385
	11	^{74}Se	3425	1486
	12	^{76}Se	3431	2564
	13	^{77}Se	3434	2786
	14	^{78}Se	3437	2079
	15	^{79}Se	3440	2932
	16	^{80}Se	3443	2486

Table 1 (continued)

Tape No.	No.	Nuclide	MAT No.	Records
305	17	^{82}Se	3449	1422
				(Total 74552)
306	1	^{79}Br	3525	3268
	2	^{81}Br	3531	3011
	3	^{78}Kr	3625	2589
	4	^{80}Kr	3631	2523
	5	^{82}Kr	3637	1860
	6	^{83}Kr	3640	1919
	7	^{84}Kr	3643	1853
	8	^{85}Kr	3646	1835
	9	^{86}Kr	3649	1664
	10	^{85}Rb	3725	1920
	11	^{87}Rb	3731	1621
	12	^{86}Sr	3831	1731
	13	^{87}Sr	3834	1706
	14	^{88}Sr	3837	2107
	15	^{89}Sr	3840	1891
	16	^{90}Sr	3843	1493
	17	^{89}Y	3925	1935
	18	^{91}Y	3931	2911
	19	Zr	4000	6545
	20	^{90}Zr	4025	2128
	21	^{91}Zr	4028	2935
	22	^{92}Zr	4031	2823
	23	^{93}Zr	4034	2161
	24	^{94}Zr	4037	2840
	25	^{95}Zr	4040	2565
	26	^{96}Zr	4043	2168
				(Total 62002)
307	1	^{93}Nb	4125	6346
	2	^{94}Nb	4128	3165

Table 1 (continued)

Tape No.	No.	Nuclide	MAT No.	Records
307	3	^{95}Nb	4131	2631
	4	Mo	4200	8895
	5	^{92}Mo	4225	2827
	6	^{94}Mo	4231	3227
	7	^{95}Mo	4234	3458
	8	^{96}Mo	4237	3098
	9	^{97}Mo	4240	3550
	10	^{98}Mo	4243	3152
	11	^{99}Mo	4246	2363
	12	^{100}Mo	4249	2612
	13	^{99}Tc	4331	2459
	14	^{96}Ru	4425	2049
	15	^{98}Ru	4431	2084
	16	^{99}Ru	4434	2187
	17	^{100}Ru	4437	2264
	18	^{101}Ru	4440	3114
	19	^{102}Ru	4443	2292
	20	^{103}Ru	4446	2109
	21	^{104}Ru	4449	1695
	22	^{106}Ru	4455	1485
				(Total 67062)

308	1	^{103}Rh	4525	2522
	2	^{105}Rh	4531	2349
	3	^{102}Pd	4625	2249
	4	^{104}Pd	4631	1905
	5	^{105}Pd	4634	3031
	6	^{106}Pd	4637	2512
	7	^{107}Pd	4640	2728
	8	^{108}Pd	4643	2268
	9	^{110}Pd	4649	1914
	10	Ag	4700	9543
	11	^{107}Ag	4725	7040

Table 1 (continued)

Tape No.	No.	Nuclide	MAT No.	Records
308	12	^{109}Ag	4731	6757
	13	^{110m}Ag	4735	3322
	14	Cd	4800	7284
	15	^{106}Cd	4825	2084
	16	^{108}Cd	4831	2819
	17	^{110}Cd	4837	2484
	18	^{111}Cd	4840	2183
	19	^{112}Cd	4843	1955
	20	^{113}Cd	4846	2246
	21	^{114}Cd	4849	1781
	22	^{116}Cd	4855	1614
	23	^{113}In	4925	2775
	24	^{115}In	4931	2481
				(Total 77846)
309	1	^{112}Sn	5025	2386
	2	^{114}Sn	5031	2478
	3	^{115}Sn	5034	2179
	4	^{116}Sn	5037	1744
	5	^{117}Sn	5040	2076
	6	^{118}Sn	5043	1610
	7	^{119}Sn	5046	2374
	8	^{120}Sn	5049	2155
	9	^{122}Sn	5055	1604
	10	^{123}Sn	5058	2092
	11	^{124}Sn	5061	2140
	12	^{126}Sn	5067	1505
	13	Sb	5100	4907
	14	^{121}Sb	5125	3476
	15	^{123}Sb	5131	3163
	16	^{124}Sb	5134	1990
	17	^{125}Sb	5137	2966
	18	^{120}Te	5225	1882

Table 1 (continued)

Tape No.	No.	Nuclide	MAT No.	Records
309	19	^{122}Te	5231	1990
	20	^{123}Te	5234	2508
	21	^{124}Te	5237	2455
	22	^{125}Te	5240	2603
	23	^{126}Te	5243	2203
	24	^{127m}Te	5247	2536
	25	^{128}Te	5249	1746
	26	^{129m}Te	5253	2786
	27	^{130}Te	5255	1600
	28	^{127}I	5325	2592
	29	^{129}I	5331	2595
	30	^{131}I	5337	2432
				(Total 70773)
310	1	^{124}Xe	5425	2338
	2	^{126}Xe	5431	2087
	3	^{128}Xe	5437	2402
	4	^{129}Xe	5440	2402
	5	^{130}Xe	5443	1552
	6	^{131}Xe	5446	2046
	7	^{132}Xe	5449	1840
	8	^{133}Xe	5452	2291
	9	^{134}Xe	5455	1625
	10	^{135}Xe	5458	2204
	11	^{136}Xe	5461	1851
	12	^{133}Cs	5525	2643
	13	^{134}Cs	5528	3309
	14	^{135}Cs	5531	2037
	15	^{136}Cs	5534	1773
	16	^{137}Cs	5537	2013
	17	^{130}Ba	5625	1962
	18	^{132}Ba	5631	2054
	19	^{134}Ba	5637	2170

Table 1 (continued)

Tape No.	No.	Nuclide	MAT No.	Records
310	20	^{135}Ba	5640	2204
	21	^{136}Ba	5643	1954
	22	^{137}Ba	5646	1951
	23	^{138}Ba	5649	2317
	24	^{140}Ba	5655	1880
	25	^{138}La	5725	2565
	26	^{139}La	5728	2307
	27	^{140}Ce	5837	2568
	28	^{141}Ce	5840	3192
	29	^{142}Ce	5843	2249
	30	^{144}Ce	5849	1757
	31	^{141}Pr	5925	2248
	32	^{143}Pr	5931	2408
	33	^{142}Nd	6025	2167
	34	^{143}Nd	6028	2434
	35	^{144}Nd	6031	2107
	36	^{145}Nd	6034	2812
	37	^{146}Nd	6037	2256
	38	^{147}Nd	6040	2492
	39	^{148}Nd	6043	2303
	40	^{150}Nd	6049	2255
				(Total 89025)
311	1	^{147}Pm	6149	2376
	2	^{148}Pm	6152	2016
	3	^{148m}Pm	6153	1918
	4	^{149}Pm	6155	2660
	5	^{144}Sm	6225	3194
	6	^{147}Sm	6234	2731
	7	^{148}Sm	6237	2375
	8	^{149}Sm	6240	2589
	9	^{150}Sm	6243	2821
	10	^{151}Sm	6246	3026

Table 1 (continued)

Tape No.	No.	Nuclide	MAT No.	Records
311	11	^{152}Sm	6249	2413
	12	^{153}Sm	6252	3334
	13	^{154}Sm	6255	3249
	14	Eu	6300	7715
	15	^{151}Eu	6325	4578
	16	^{152}Eu	6328	2568
	17	^{153}Eu	6331	4641
	18	^{154}Eu	6334	2292
	19	^{155}Eu	6337	2355
	20	^{156}Eu	6340	1933
	21	^{152}Gd	6425	3170
	22	^{154}Gd	6431	3069
	23	^{155}Gd	6434	3487
	24	^{156}Gd	6437	2887
	25	^{157}Gd	6440	3360
	26	^{158}Gd	6443	2758
	27	^{160}Gd	6449	2333
	28	^{159}Tb	6525	3150
				(Total 84998)
312	1	Hf	7200	6763
	2	^{174}Hf	7225	4245
	3	^{176}Hf	7231	5247
	4	^{177}Hf	7234	5021
	5	^{178}Hf	7237	5043
	6	^{179}Hf	7240	4422
	7	^{180}Hf	7243	3944
	8	^{181}Ta	7328	4629
	9	W	7400	8478
	10	^{182}W	7431	3669
	11	^{183}W	7434	3395
	12	^{184}W	7437	3207
	13	^{186}W	7443	3362

Table 1 (continued)

Tape No.	No.	Nuclide	MAT No.	Records
312	14	Pb	8200	7506
	15	^{204}Pb	8225	5270
	16	^{206}Pb	8231	5823
	17	^{207}Pb	8234	5189
	18	^{208}Pb	8237	5472
	19	^{209}Bi	8325	4163
				(Total 94848)
313	1	^{223}Ra	8825	1277
	2	^{224}Ra	8828	1069
	3	^{225}Ra	8831	847
	4	^{226}Ra	8834	1393
	5	^{225}Ac	8925	612
	6	^{226}Ac	8928	568
	7	^{227}Ac	8931	990
	8	^{227}Th	9025	668
	9	^{228}Th	9028	1597
	10	^{229}Th	9031	857
	11	^{230}Th	9034	1551
	12	^{232}Th	9040	2984
	13	^{233}Th	9043	1852
	14	^{234}Th	9046	1925
	15	^{231}Pa	9131	1756
	16	^{232}Pa	9134	720
	17	^{233}Pa	9137	1670
	18	^{232}U	9219	1339
	19	^{233}U	9222	4154
	20	^{234}U	9225	3033
	21	^{235}U	9228	6920
	22	^{236}U	9231	2824
	23	^{237}U	9234	3116
	24	^{238}U	9237	8245
	25	^{236}Np	9343	934

Table 1 (continued)

Tape No.	No.	Nuclide	MAT No.	Records
313	26	^{237}Np	9346	3140
	27	^{238}Np	9349	2341
	28	^{239}Np	9352	942
				(Total 59324)
314	1	^{236}Pu	9428	1056
	2	^{238}Pu	9434	2454
	3	^{239}Pu	9437	6202
	4	^{240}Pu	9440	5821
	5	^{241}Pu	9443	2503
	6	^{242}Pu	9446	2492
	7	^{241}Am	9543	1894
	8	^{242}Am	9546	1598
	9	^{242m}Am	9547	2197
	10	^{243}Am	9549	1544
	11	^{244}Am	9552	2223
	12	^{244m}Am	9553	2237
	13	^{241}Cm	9628	866
	14	^{242}Cm	9631	954
	15	^{243}Cm	9634	1815
	16	^{244}Cm	9637	1448
	17	^{245}Cm	9640	2906
	18	^{246}Cm	9643	2320
	19	^{247}Cm	9646	1877
	20	^{248}Cm	9649	1125
	21	^{249}Cm	9652	1238
	22	^{250}Cm	9655	849
	23	^{249}Bk	9752	1872
	24	^{250}Bk	9755	1936
	25	^{249}Cf	9852	1675
	26	^{250}Cf	9855	2229
	27	^{251}Cf	9858	2148
	28	^{252}Cf	9861	1298

Table 1 (continued)

Tape No.	No.	Nuclide	MAT No.	Records
314	29	^{254}Cf	9867	804
	30	^{254}Es	9914	795
	31	^{255}Es	9915	907
	32	^{255}Fm	9936	790
				(Total 62073)
315	1	^{232}Th	9040	3313
	2	^{233}U	9222	4948
	3	^{235}U	9228	4948
	4	^{236}U	9231	1673
	5	^{238}U	9237	3312
	6	^{237}Np	9346	1673
	7	^{239}Pu	9437	4948
	8	^{240}Pu	9440	1672
	9	^{241}Pu	9443	3310
	10	^{242}Pu	9446	1672
	11	^{241}Am	9543	69
	12	^{243}Am	9549	69
				(Total 31607)

*) The nuclide without a mass number stands for a natural element.

**) Tape 315 contains fission product yields.

MAT number = 125

1-H - 1 JAERI EVAL-DEC84 K.SHIBATA
JAERI-1261 DIST-SEP89 REV2-APR93

HISTORY
83-03 COMPILED BY K.SHIBATA FOR JENDL-2
MAIN PART WAS CARRIED OVER FROM JENDL-1 DATA EVALUATED BY M.YAMAMOTO. DETAILS ARE GIVEN IN REF. /1/.
83-11 MF=2 WAS ADDED. THE TRANSFORMATION MATRIX GIVEN FOR MT=2 OF MF=4.
84-12 RE-EVALUATED BY K.SHIBATA (JAERI) FOR JENDL-3
ELASTIC SCATTERING CROSS SECTION WAS RE-CALCULATED BELOW 100 KEV.
MU-BAR WAS ALSO RE-CALCULATED.
PHOTON-PRODUCTION CROSS SECTION WAS ADDED.
93-04 JENDL-3.2 COMPILED BY T.NAKAGAWA (NDC/JAERI)

***** MODIFIED PARTS FOR JENDL-3.2 ********************
(4,2) TRANSFORMATION MATRIX
****

MF=1 GENERAL INFORMATION
MT=451 DESCRIPTIVE DATA AND DICTIONARY

MF=2 RESONANCE PARAMETERS
MT=151 SCATTERING RADIUS ONLY

MF=3 NEUTRON CROSS SECTIONS
CALCULATED 2200M/S CROSS SECTIONS AND RES. INTEGRALS

	2200M/S (B)	RES. INTEG. (B)
TOTAL	20.806	-
ELASTIC	20.474	-
CAPTURE	0.332	0.1491

MT=1 TOTAL CROSS SECTION
SUM OF ELASTIC AND CAPTURE CROSS SECTIONS
MT=2 ELASTIC SCATTERING CROSS SECTION
BELOW 100 KEV, CALCULATED BY USING EFFECTIVE RANGE AND SCATTERING LENGTH PARAMETERS OF POENITZ AND WHALEN /2/. ABOVE 100 KEV, THE DATA OF HOPKINS AND BREIT/3/ WERE RECOMMENDED.
MT=102 CAPTURE CROSS SECTION
THE DATA OF HORSLEY/4/ WERE RECOMMENDED.
MT=251 MU-BAR
CALCULATED FROM THE DATA IN MF=4.

MF=4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=2
BELOW 100 KEV, ISOTROPIC IN THE CENTER OF MASS SYSTEM WAS ASSUMED. ABOVE 100 KEV, THE DATA OF HOPKINS AND BREIT/3/ WERE RECOMMENDED.

MF=12 PHOTON PRODUCTION MULTIPLICITY
MT=102
M=1.0

MF=14 PHOTON ANGULAR DISTRIBUTION
MT=102
ASSUMED TO BE ISOTROPIC.

REFERENCES
1) IGARASI S. ET AL.: JAERI-1261 (1979).
2) POENITZ W.P. AND WHALEN J.F.: NUCL. PHYS. A383 (1982) 224.
3) HOPKINS J.C. AND BREIT G.: NUCL. DATA TABLE A9(1971) 137.
4) HORSLEY A.: NUCL. DATA A2(1966) 243.

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MAT number =  128
  1-H -  2 JAERI      EVAL-JUL82 K.SHIBATA,T.NARITA,S.IGARASI
JAERI-M 83-006        DIST-MAR83 REV2-APR93
HISTORY
83-01 NEW EVALUATION FOR JENDL-2.  DETAILS ARE GIVEN IN REF. /1/.
      DATA WERE COMPILED BY THE AUTHORS.
83-11 MF=2 WAS ADDED.
87-05 CARRIED OVER FROM JENDL-2.
93-04 JENDL-3.2 COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (4,2)              TRANSFORMATION MATRIX
     ***********************************************************

MF=1  GENERAL INFORMATION
  MT=451   DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
  MT=151   SCATTERING RADIUS ONLY

MF=3  NEUTRON CROSS SECTIONS
      2200-M/S CROSS SECTIONS AND CALCULATED RES. INTEGRALS.
                  2200-M/S       RES. INTEG.
         ELASTIC    3.389   B        -
         CAPTURE    0.00055 B      0.000286 B
         TOTAL      3.390   B        -

  MT=1     TOTAL
        BASED ON A LEAST-SQUARES FIT TO THE EXPERIMENTAL DATA OF
        /2/-/8/.
  MT=2     ELASTIC
        ELASTIC = TOTAL - (N,2N) - CAPTURE.
  MT=16    (N,2N)
        BASED ON A LEAST-SQUARES FIT.
        DATA LISTED IN /9/-/11/ WERE USED.
  MT=102   CAPTURE
        BELOW 1 KEV, 1/V FORM NORMALIZED TO THE DATA OF
                     ISHIKAWA /12/.
        ABOVE 1 KEV, EVALUATED ON THE BASIS OF THE INVERSE
                     REACTION /13/.
  MT=251   MU-BAR
        CALCULATED FROM THE DATA IN MF=4.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,16
        CALCULATED FROM THE THREE-BODY MODEL BASED ON
        THE FADDEEV EQUATION /14/.

MF=5    ENERGY DISTRIBUTIONS OF SECONDARY
        NEUTRONS
  MT=16 THE THREE-BODY MODEL CALCULATION.
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REFERENCES


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MAT number =  225
  2-HE-  3 JAERI      EVAL-JUN87 K.SHIBATA
 JAERI-M 90-024       DIST-SEP89 REV2-JAN94
HISTORY
87-06  NEWLY EVALUATED BY K.SHIBATA
94-01  MODIFIED BY K.SHIBATA FOR JENDL-3.2
****  MODIFIED PARTS FOR JENDL-3.2  ***********************
(3,102),(12,102),(14,102)   ADDED
(3,3)                       CALCULATED
(3,1)                       SUM OF PARTIAL CROSS SECTIONS
***********************************************************

MF=1          GENERAL INFORMATION
  MT=451   DESCRIPTIVE DATA

MF=2          RESONANCE PARAMETERS
  MT=151   SCATTERING RADIUS ONLY

MF=3          NEUTRON CROSS SECTIONS
       CALCULATED 2200M/S CROSS SECTIONS AND RES. INTEGRALS
              2200M/S (B)      RES.INTEG (B)
     TOTAL     5331.1              -
     ELASTIC   3.135               -
     CAPTURE   5.401E-5          2.4691E-4
     (N,P)     5328.0              -

  MT=1     TOTAL
        BELOW 1 MEV, THE EXPERIMENTAL DATA /1/ WERE ANALYZED USING
        THE R-MATRIX THEORY.
        ABOVE 1 MEV, BASED ON EXPERIMENTAL DATA /2-4/.
  MT=2     ELASTIC
        BELOW 1 MEV, THE EXPERIMENTAL DATA /1/ WERE ANALYZED USING
        THE R-MATRIX THEORY.
        ABOVE 1 MEV, (ELASTIC) = (TOTAL) - (NON ELASTIC)
  MT=3     NON-ELASTIC
        SUM OF (3,102), (3,103) AND (3,104)
  MT=102   CAPTURE
        S- AND P-WAVE CAPTURE, BASED ON EXPERIMENTAL DATA /5,6,7/.
  MT=103   (N,P)
        BELOW 1 MEV, THE EXPERIMENTAL DATA /8/ WERE ANALYZED USING
        THE R-MATRIX THEORY.
        ABOVE 1 MEV, BASED ON EXPERIMENTAL DATA /9,10/.
  MT=104   (N,D)
        EVALUATION WAS PERFORMED ON THE BASIS OF EXPERIMENTAL
        DATA /9,10/.
  MT=251   MU-BAR
        CALCULATED FROM THE DATA IN FILE-4.

MF=4          ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2     ELASTIC
        BASED ON THE FOLLOWING EXPERIMENTAL DATA:
          1.0E-5 EV TO 500 KEV : ISOTROPIC IN C.M.
          1.0, 2.0, 3.5 MEV    : SEAGRAVE ET AL. /11/
          5 TO 20 MEV          : HAESNER /9/

MF=12         PHOTON PRODUCTION MULTIPLICITY
  MT=102   CAPTURE
        M=1.0 FOR THE TRANSITION TO G.S OF HE-4.

MF=14         PHOTON ANGULAR DISTRIBUTION
  MT=102   CAPTURE
        ASSUMED TO BE ISOTROPIC.

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MAT number = 228

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  2-HE-  4 JAERI      EVAL-FEB87 K.SHIBATA
                      DIST-SEP89
HISTORY
87-02  NEWLY EVALUATED BY K.SHIBATA

MF=1          GENERAL INFORMATION
  MT=451   DESCRIPTIVE DATA

MF=2          RESONANCE PARAMETERS
  MT=151   SCATTERING RADIUS ONLY

MF=3          CROSS SECTIONS
        CALCULATED 2200M/S CROSS SECTIONS
             TOTAL   0.7593 BARN
             ELASTIC 0.7593 BARN

  MT=1,2   SIG-T, SIG-EL
        EXPERIMENTAL DATA /1/-/6/ WERE ANALYZED USING
        THE R-MATRIX THEORY.
  MT=251   MU-BAR
        CALCULATED FROM THE DATA IN FILE-4

MF=4          ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2     ELASTIC
        R-MATRIX CALCULATIONS
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MAT number =  325
  3-LI-  6 JAERI      EVAL-MAR85 S.CHIBA AND K.SHIBATA
JAERI-M 88-164        DIST-SEP89 REV2-DEC93
HISTORY
83-12  NEWLY EVALUATED BY K.SHIBATA
84-07  DATA OF MF=4 (MT=16,91) AND MF=5 (MT=16,91) WERE REVISED.
       COMMENT WAS ALSO MODIFIED.
85-03  MODIFIED BY S. CHIBA
       DATA OF MF=3 (MT=59,63) AND MF=4 (MT=59,63) WERE ADDED.
       DATA OF MF=3 (MT=16), MF=4 (MT=2,16,53), MF=5 (MT=16)
       WERE REVISED.
       PSEUDO-LEVEL REPRESENTATION WAS ADOPTED FOR THE
       (N,N')ALPHA-D CONTINUUM (MT=51,52,54-56,58,60-62,64-86).
93-12  MODIFIED BY S. CHIBA FOR JENDL-3.2
       DATA OF MF=3 (MT=2,3,4,54-56,58,82) AND MF=4 (MT=16,51,52,
       54-58,60-86) WERE ADJUSTED MAMUALLY TO REPRODUCE THE DDX
       DATA AT 14 AND 18 MEV /1,2,3/.

****  MODIFIED PARTS FOR JENDL-3.2  ******************************
(3,2),(3,3),(3,4),(3,54-56),(3,58-82)              ABOVE 10 MEV
(4,16),(4,51-52),(4,54-58),(4,60-86)
*****************************************************************

MF=1          GENERAL INFORMATION
  MT=451    DESCRIPTIVE DATA

MF=2          RESONANCE PARAMETERS
  MT=151    SCATTERING RADIUS ONLY.

MF=3          CROSS SECTIONS
        CALCULATED 2200M/S CROSS SECTIONS AND RES. INTEGRALS
                   2200M/S (B)     RES. INTEG. (B)
        TOTAL      94.11                -
        ELASTIC    0.735                -
        CAPTURE    0.039             0.017
        (N,T)      94.03                -

  MT=1        SIG-T
        BELOW 1 MEV BASED ON THE R-MATRIX CALCULATION.  SIG-CAP
        WAS ADDED TO THE CALCULATED CROSS SECTION.
        ABOVE 1 MEV, BASED ON THE EXPERIMENTAL DATA /4,5,6/.
  MT=2        SIG-EL
        BELOW 1 MEV, BASED ON THE R-MATRIX CALCULATION.
        ABOVE 1 MEV, THE CROSS SECTION WAS OBTAINED BY SUBTRACTING
        THE REACTION CROSS SECTION FROM THE TOTAL CROSS SECTION.
  MT=3        NON-ELASTIC
        SUM OF MT=4, 16, 102, 103 AND 107.
  MT=4        TOTAL INELASTIC
        SUM OF MT=51, 52, 53, 54 AND 91.
  MT=16       (N,2N)LI5
        BASED ON THE EXPERIMENTAL DATA /7,8,9/.
  MT=53       SIG-IN    2.185 MEV
        BASED ON THE EXPERIMENTAL DATA /1,2,3,6,10,11,12,13/.
  MT=57       SIG-IN    3.562 MEV
        BASED ON THE EXPERIMENTAL DATA /1,2,3,6,14/
  MT=59       SIG-IN    4.31 MEV
        BASED ON A COUPLED-CHANNEL CALCULATION. THE SYMMETRIC
        ROTATIONAL MODEL WAS ASSUMED. THE COUPLING SCHEME WAS
        1+(G.S.) - 3+(2.185) - 2+(4.31) - 1+(5.7).
        THE POTENTIAL PARAMETERS WERE;
         V  = 45.0766 MEV,          R = 1.1875 FM, A  = 0.57335 FM
         WS = 0.4432*EL-1.1631 MEV, RI= 1.6113 FM, AI = 0.26735 FM
         VSO= 5.5 MEV,              RSO=1.15 FM,   ASO= 0.5 FM
         BETA(2)=1.1395,
        WHERE EL MEANS THE INCIDENT NEUTRON ENERGY IN THE LAB.
        SYSTEM (MEV).
        ABOVE 10 MEV, BASED ON EXPERIMENTAL DATA /1,2,3/.
  MT=63       SIG-IN    5.7 MEV
        BASED ON THE CC CALCULATION NORMALIZED TO THE EXPERIMENTAL
        DATA /9/.  ABOVE 10 MEV, BASED ON EXPERIMENTAL DATA
        /1,2,3/.
  MT=51,52,54-56,58,60-62,64-86 (N,N')ALPHA-D CONTINUUM
        REPRESENTED BY PSEUDO-LEVELS, BINNED IN 0.5 MEV INTERVALS.
        THE (N,N')ALPHA-D CROSS SECTION WAS BASED ON THE MEASURE-
        MENT OF ROSEN AND STEWART /15/.  THE CONTRIBUTION FROM
        MT=53, 59 AND 63 WAS SUBTRACTED SO THAT SIG-T MIGHT BE
        EQUAL TO THE SUM OF PARTIAL CROSS SECTIONS. THE CROSS
        SECTION FOR EACH LEVEL WAS CALCULATED BY THE 3-BODY PHASE-
        SPACE DISTRIBUTION WITH A CORRECTION OF THE COULOMB
        INTERACTION IN THE FINAL STATE, ASSUMING ISOTROPIC CENTER-
        OF-MASS DISTRIBUTIONS.  ADJUSTED TO REPRODUCE THE DDX DATA
        AT 14 AND 18 MEV /1,2,3/
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  MT=102     CAPTURE
        BELOW 100 KEV, 1/V CURVE NORMALIZED TO THE THERMAL DATA OF
        JURNEY /16/.  ABOVE 100 KEV, THE INVERSE REACTION DATA OF
        FERDINANDE ET AL./17/ WERE ADDED.
  MT=103     (N,P)
        BASED ON THE EXPERIMENTAL DATA /18,19/.
  MT=105     (N,T)ALPHA
        BELOW 1 MEV, R-MATRIX CALCULATION.
        ABOVE 1 MEV, BASED ON THE EXPERIMENTAL DATA /20,21/.
  MT=251     MU-BAR
        CALCULATED FROM THE DATA IN FILE4.

MF=4          ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2
        BELOW 500 KEV, R-MATRIX CALCULATION.
        BETWEEN 500 KEV AND 14 MEV, BASED ON THE EXPERIMENTAL
        DATA /4,10,22/.
        ABOVE 15 MEV, BASED ON THE CC CALCULATION.
  MT=16
        BASED ON THE EXPERIMENTAL DATA /1,2,3,9/.
        ANGULAR DISTRIBUTIONS ARE GIVEN IN THE LABORATORY SYSTEM.
  MT=53
        BELOW 4.8 MEV, ASSUMED TO BE ISOTROPIC IN CM.
        BETWEEN 4.8 AND 14 MEV, BASED ON THE EXPERIMENTAL DATA
        /10,23/.
        ABOVE 15 MEV, THE CC CALCULATION.
  MT=57
        BASED ON EXPERIMENTAL DATA /1,2,3/.
  MT=59
        BASED ON THE CC CALCULATION.
  MT=63
        BASED ON EXPERIMENTAL DATA /1,2,3/.
  MT=51,52,54-56,58,60-62,64-86
        ADJUSTED TO REPRODUCE THE DATA /1,2,3/.

MF=5          ENERGY DISTRIBUTION OF SECONDARY NEUTRONS
  MT=16
        THE EVAPORATION MODEL WAS ASSUMED. THE EVAPORATION
        TEMPERATURE OF REF./9/ WAS ADOPTED. IT WAS EXTRAPOLATED
        AS
          T = 0.176497*SQRT(EL) MEV,
        WHERE EL MEANS THE INCIDENT NEUTRON ENERGY IN THE LAB.
        SYSTEM (MEV).

MF=12         PHOTON-PRODUCTION MULTIPLICITIES
  MT=57
        M=1.0
  MT=102
        BASED ON THE THERMAL MEASUREMENT OF JURNEY /15/.

MF=14         PHOTON ANGULAR DISTRIBUTIONS
  MT=57
        ISOTROPIC
  MT=102
        ASSUMED TO BE ISOTROPIC.
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MAT number = 328

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  3-LI-  7 JAERI       EVAL-DEC84 S.CHIBA AND K.SHIBATA
 JAERI-M 88-164        DIST-SEP89 REV2-NOV92
HISTORY
83-12  NEWLY EVALUATED BY K.SHIBATA
84-07  DATA OF MF=4 (MT=16,91) AND MF=5 (MT=16,91) WERE REVISED.
       COMMENT WAS ALSO MODIFIED.
84-12  MODIFIED BY S. CHIBA
       DATA OF MT=62 AND 64(MF=3,4) WERE ADDED.  DATA OF MF=4
       (MT=2,51,57,16) AND MF=5 (MT=16,91) WERE MODIFIED.
       PSEUDO-LEVEL REPRESENTATION WAS ADOPTED FOR THE
       (N,N')ALPHA-T CONTINUUM (MT=52-56,58-61,63,65-84).
       COMMENT WAS ALSO MODIFIED.
87-02  LI7(N,NT) CROSS SECTION WAS MODIFIED.
88-02  LI7(N,N2) CROSS SECTION AND ANG. DIST. WERE MODIFIED.
       LI7(N,N0) WAS ALSO MODIFIED SO AS TO GIVE THE TOTAL CROSS
       SECTION WHICH IS EQUAL TO JENDL-3PR1.  THE LI7(N,N1) ANG.
       DIST. WAS ALSO MODIFIED.  LI7(N,NT) CROSS SECTION WAS
       FIXED TO 87-02 VERSION BY MODIFYING THE PSEUDO-LEVEL
       CROSS SECTIONS. COMMENT WAS ALSO MODIFIED.
92-11 JENDL-3.2
      COMPILED BY T.NAKAGAWA

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (4,2)     NUMBER OF ELEMENTS OF TRANSFORMATION MATRIX
     ***********************************************************


MF=1          GENERAL INFORMATION
  MT=451    DESCRIPTIVE DATA

MF=2          RESONANCE PARAMETERS
  MT=151    SCATTERING RADIUS ONLY.

MF=3          CROSS SECTIONS
         CALCULATED 2200M/S CROSS SECTIONS AND RES. INTEGRALS
                 2200 M/S (B)          RES. INTEG. (B)
        TOTAL     1.015                       -
        ELASTIC   0.97                        -
        CAPTURE   0.045                     0.020

  MT=1        SIG-T
        BELOW 100 KEV, SIG-T = 0.97 + SIG-CAP (BARNS).
        ABOVE 100 KEV, BASED ON THE EXPERIMENTAL DATA /1/-/4/.
  MT=2        SIG-EL
        BELOW 100 KEV, SIG-EL = 0.97 (BARNS).
        ABOVE 100 KEV, SIG-EL = SIG-T - SIG-REACT.
  MT=3        NON-ELASTIC
        SUM OF MT=4, 16, 102 AND 104.
  MT=4        TOTAL INELASTIC
        SUM OF MT=51 TO 84.
  MT=16       (N,2N)
        BASED ON THE EXPERIMENTAL DATA /5/,/6/.
  MT=51       SIG-IN    0.478 MEV
        BASED ON THE (N,N'GAMMA) DATA OF MORGAN /7/.
  MT=57       SIG-IN    4.63 MEV
        BASED ON THE EXPERIMENTAL DATA /8/-/10/.
  MT=62       SIG-IN    6.68 MEV
        BASED ON A COUPLED-CHANNEL CALCULATION NORMALIZED TO THE
        EXPERIMENTAL DATA /13,14/. THE SYMMETRIC ROTATIONAL MODEL
        WAS ASSUMED.  THE COUPLING SCHEME WAS
        3/2-(G.S.) - 1/2-(0.478) - 7/2-(4.63) - 5/2-(6.68).
        THE POTENTIAL PARAMETERS WERE AS FOLLOWS;
        V= 49.6 - 0.362*EL MEV, R= 1.28 FM, A= 0.620 FM
        WS= -13.2 + 1.88*EL MEV, RI= 1.34 FM, AI= 0.104 FM
        VSO= 5.500 MEV, RSO=1.150 FM, ASO=0.50 FM
        BETA(2)= 0.952,
        WHERE EL MEANS LABORATORY INCIDENT ENERGY IN MEV.
  MT=64       SIG-IN    7.467 MEV
        ASSUMED TO HAVE THE SAME EXCITATION FUNCTION AS MT=53,
        NORMALIZED TO THE EXPERIMENTAL DATA /13,14/.
  MT=52-56,58-61,63,65-84, (N,N')ALPHA-T CONTINUUM
        REPRESENTED BY PSEUDO-LEVELS, BINNED IN 0.5 MEV INTERVALS.
        THE CROSS SECTION WAS OBTAINED BY SUBTRACTING THE
        CONTRIBUTION OF MT=57,62 AND 64 FROM THE (N,N')ALPHA-T
        CROSS SECTION (MT=205). THE CROSS SECTION FOR EACH LEVEL
        WAS CALCULATED BY THE 3-BODY PHASE-SPACE DISTRIBUTION WITH
        A CORRECTION OF THE COULOMB INTERACTION IN THE FINAL
        STATE.
  MT=102      CAPTURE
        1/V NORMALIZED TO THE THERMAL MEASUREMENT /15/.
  MT=104      (N,D)
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        THE (N,D) CROSS SECTION WAS CALCULATED WITH DWBA.
        NORMALIZATION WAS TAKEN SO THAT THE CALCULATED CROSS
        SECTION MIGHT BE CONSISTENT WITH THE ACTIVATION DATA /16/.
  MT=205    (N,N')ALPHA-T
        BASED ON THE EXPERIMENTAL DATA /17/-/22/.
  MT=251    MU-BAR
        CALCULATED FROM THE DATA IN FILE4.

MF=4          ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2
        BELOW 4 MEV, AN R-MATRIX CALCULATION WITH THE PARAMETERS
        OF KNOX AND LANE/23/.
        BETWEEN 4 MEV AND 14 MEV, BASED ON THE EXPERIMENTAL
        DATA /8/,/24/.
        ABOVE 15 MEV, THE COUPLED-CHANNEL CALCULATION.
  MT=16
        BASED ON THE EXPERIMENTAL DATA /13/ AT 14.2 MEV.
        ANGULAR DISTRIBUTIONS ARE GIVEN IN THE LABORATORY SYSTEM.
  MT=51
        BELOW  4 MEV, THE R-MATRIX CALCULATION.
        4 TO 10 MEV, EVALUATION OF LISKIEN/25/ WAS ADOPTED.
        ABOVE 10 MEV, THE COUPLED-CHANNEL CALCULATION.
  MT=57
        BELOW 8 MEV, THE R-MATRIX CALCULATION.
        BETWEEN 8 MEV AND 14 MEV, BASED ON THE EXPERIMENTAL
        DATA /10/-/12/.
        ABOVE 15 MEV, THE COUPLED-CHANNEL CALCULATION.
  MT=62
        AT THE THRESHOLD, AN ISOTROPIC DISTRIBUTION WAS ASSUMED.
        ABOVE 10 MEV, THE COUPLED-CHANNEL CALCULATION.
  MT=64
        ISOTROPIC DISTRIBUTIONS WERE ASSUMED IN THE CENTER-OF-MASS
        SYSTEM.
  MT=52-56,58-61,63,65-84
        EXPERIMENTAL DATA/13/ WERE ADOPTED.

MF=5          ENERGY DISTRIBUTION OF SECONDARY NEUTRONS
  MT=16
        THE EVAPORATION MODEL WAS ASSUMED, WITH THE TEMPERATURE
        DEDUCED EXPERIMENTALLY/13/ AT 14.2 MEV. THE TEMPERATURE
        WAS EXTRAPOLATED AS
        T = 0.229*SQRT(EL) MEV,
        WHERE EL MEANS LABORATORY INCIDENT ENERGY IN MEV.

MF=12         PHOTON-PRODUCTION MULTIPLICITIES
  MT=51
        M=1.0
  MT=102
        MULTIPLICITIES WERE OBTAINED FROM REF./26/.

MF=14         PHOTON ANGULAR DISTRIBUTIONS
  MT=51
        ISOTROPIC
  MT=102
        ASSUMED TO BE ISOTROPIC.
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MAT number = 425

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  4-BE-  9 JAERI      EVAL-AUG84 K.SHIBATA
 JAERI-M 84-226       DIST-SEP89 REV1-OCT90
HISTORY
84-08 REEVALUATED FOR JENDL-3 BY K.SHIBATA.
      DETAILS OF THE EVALUATION ARE GIVEN IN REF/1/.
89-01 MODIFIED BY CONSIDERING NEUTRON EMISSION SPECTRA
90-10 MF=5, MT=16, 24, 46, 47: SPECTRA AT THRESHOLD ENERGIES WERE
      MODIFIED.

MF=1         GENERAL INFORMATION
  MT=451   DESCRIPTIVE DATA

MF=2         RESONANCE PARAMETER
  MT=151   SCATTERING RADIUS ONLY.

MF=3         CROSS SECTIONS
        CALCULATED 2200M/S CROSS SECTIONS AND RES. INTEGRALS
                      2200M/S (B)     RES. INTEG. (B)
          TOTAL        6.1586               -
          ELASTIC      6.1510               -
          CAPTURE      0.0076           0.0034

  MT=1     SIG-T
        BELOW 1 EV, SUM OF SIG-EL AND SIG-CAP.  BETWEEN 1 EV AND
        830 KEV, THE CROSS SECTION WAS CALCULATED ON THE BASIS OF
        THE R-MATRIX THEORY.  THE R-MATRIX PARAMETERS WERE
        OBTAINED SO AS TO GIVE THE BEST FIT TO THE EXPERIMENTAL
        DATA /2/-/6/.  ABOVE 830 KEV, BASED ON THE MEASUREMENTS
        /5/,/7/,/8/.
  MT=2     SIG-EL
        BELOW 1 EV, SIG-EL = 6.151 BARNS.
        ABOVE 1 EV, THE CROSS SECTION WAS OBTAINED BY SUBTRACTING
        THE REACTION CROSS SECTION FROM THE TOTAL CROSS SECTION.
  MT=3     NON-ELASTIC
        SUM OF MT=4,16,24,102,103,103,105,107
  MT=4     TOTAL INELASTIC
        SUM OF MT=51 AND 52.
  MT=6, 7, 16, 51, 52
        THE SHAPE OF THE INELASTIC SCATTERING CROSS SECTION WAS
        OBTAINED FROM THE STATISTICAL MODEL CALCULATION.  THE
        ABSOLUTE VALUE WAS DETERMINED SO THAT A SUM OF THE
        INELASTIC SCATTERING AND (N,A1) REACTION CROSS SECTIONS
        MIGHT BE EQUAL TO THE (N,2N) REACTION CROSS SECTION IN
        JENDL-2.  OPTICAL POTENTIAL PARAMETERS OF AGEE AND ROSEN
        /9/ WERE USED.
           V = 49.3 - 0.33E, WS = 5.75   , VSO = 5.5    (MEV)
           R = 1.25        , RS = 1.25   , RSO = 1.25   (FM)
           A = 0.65        , B  = 0.70   , ASO = 0.65   (FM)
        LEVEL SCHEME
           NO          ENERGY(MEV)    SPIN-PARITY
         G.S.            0.0             3/2-
             1           1.68            1/2+
             2           2.429           5/2-
             3           2.800           1/2+
             4           3.06            5/2+
             5           4.7             3/2+
             6           6.8             7/2-
             7           7.9             5/2- *)
             8           11.28           9/2- *)
             9           11.81           7/2- *)
           10            13.79           5/2- *)
           11            14.396          3/2- *)
         *) SPIN-PARITY VALUE WAS TENTATIVELY ASSIGNED.
         ALL THE EXCITED LEVELS EXCEPT 7.9 AND 13.79 MEV ONES
         DECAY BY EMITTING NEUTRONS, CONTRIBUTING TO THE (N,2N)
         CROSS SECTION.  WITHIN THE FRAMEWORK OF THE CURRENT
         ENDF/B FORMAT, DIFFERENT MT NUMBERS WERE ASSIGNED TO
         THESE LEVELS.
                   MT NO.                 LEVEL
                     6                     2ND+3RD+4TH
                     7                     6TH
                    16                     1ST+5TH+8TH+9TH+11TH+CONT
                    51                     7TH
                    52                     10TH
      ************************************************************
      *  THE (N,2N) CROSS SECTIONS IS GIVEN AS A SUM OF MT=6, 7, *
      *  16, AND 24.                                             *
      ************************************************************
  MT=24    (N,2N ALPHA)
        THIS IS THE CROSS SECTION FOR THE (N,A1) REACTION.  THE
        1ST EXCITED LEVEL OF HE-6 DECAYS BY EMITTING 2 NEUTRONS.
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        THE (N,A1) CROSS SECTION WAS CALCULATED WITH THE
        STATISTICAL MODEL.
        ALPHA POTENTIAL PARAMETERS ARE THE FOLLOWING /10/:
           V = 125.0   , WS = 15.0   , VSO = 0.0        (MEV)
           R = 1.56    , RS = 1.56   , RC  = 1.22       (FM)
           A = 0.50    , B  = 0.11                      (FM)
        THE CROSS SECTION WAS NORMALIZED TO THE DATA OF
        PERROUD AND SELLEM /11/ AT 14 MEV.
  MT=46, 47   SIG-IN
        SAME AS MT=6, 7, RESPECTIVELY.
  MT=102   CAPTURE
        THERMAL CROSS SECTION OF 7.6E-3 BARN WAS OBTAINED FROM
        THE RECOMMENDATION BY MUGHABGHAB ET AL./12/
        1/V CURVE WAS ASSUMED OVER THE WHOLE ENERGY RANGE.
  MT=103   (N,P)
        CALCULATED WITH THE STATISTICAL MODEL.
        PROTON POTENTIAL PARAMETERS ARE THE FOLLOWING /13/:
           V = 59.5 - 0.36E, WS = 12.0 + 0.07E, VSO = 4.9   (MEV)
           R = 1.24        , RS = 1.36        , RSO = 1.2   (FM)
           RC= 1.3                                          (FM)
           A = 0.63        , B  = 0.35        , ASO = 0.31  (FM)
        THE CROSS SECTION WAS NORMALIZED TO THE EXPERIMENTAL DATA
        OF AUGUSTSON AND MENLOVE /14/, WHO MEASURED DELAYED
        NEUTROS, BY TAKING ACCOUNT OF THE BRANCHING RATIO
        OF 49.5% FOR LI-9 => BE-9* => 2A + N.
  MT=104   (N,D)
        BASED ON THE EXPERIMENTAL DATA OF SCOBEL /15/.
  MT=105   (N,T)
        SUM OF MT=740 AND 741.
  MT=107   (N,A0)
        BASED ON THE EXPERIMENTAL DATA /10/,/11/,/16/-/19/.
  MT=251   MU-BAR
        CALCULATED FROM THE DATA IN FILE4.
  MT=740, 741   (N,T0),(N,T1)
        CALCULATED WITH THE STATISTICAL MODEL.
        TRITON POTENTIAL PARAMETERS ARE THE FOLLOWING /20/:
           V = 140.0   , WS = 7.5   , VSO = 6.0                  (MEV)
           R = 1.20    , RS = 2.69  , RSO = 1.20 , RC = 1.30 (FM)
           A = 0.45    , B  = 0.36  , ASO = 0.7                  (FM)
        NORMALIZATION WAS TAKEN SO THAT THE TOTAL (N,T) CROSS
        SECTION MIGHT BE CONSISTENT WITH THE EXPERIMENTAL DATA
        OF BOEDY ET AL./21/

MF=4          ANGULAR DISTRIBUTIONS
  MT=2
        1.0E-5 EV TO 50 KEV   ISOTROPIC IN CM.
        50 KEV TO 14 MEV      BASED ON THE EXPERIMENTAL DATA
                              /22/-/27/.
        14 MEV TO 20 MEV      OPTICAL-MODEL CALCULATIONS USING
                              THE POTENTIAL PARAMETERS OF
                              AGEE AND ROSEN /9/.
  MT=6
        LEGENDRE COEFFICIENTS WERE DERIVED FROM THE EXPERIMENTAL
        DATA /27/,/28/.
  MT=7
        STATISTICAL MODEL CALCULATION
  MT=16
        KALBACH-MANN SYSTEMATICS/31/
  MT=24, 46, 47
        CALCULATED BY ASSUMING THE TWO-STEP SEQUENTIAL REACTION
        /29/.

MF=5          ENERGY DISTRIBUTION
  MT=16
        EVAPORATION PLUS 3-BODY PHASE SPACE
  MT=24, 46, 47
        CALCULATED BY ASSUMING THE TWO-STEP SEQUENTIAL REACTION
        /29/.

MF=12         PHOTON-PRODUCTION MULTIPLICITIES
  MT=102
        BASED ON THE MEASUREMENT OF JURNEY /30/.
  MT=741
        M=1.0

MF=14         PHOTON ANGULAR DISTRIBUTIONS
  MT=102
        ASSUMED TO BE ISOTROPIC.
  MT=741
        ISOTROPIC

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MAT number = 525

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  5-B - 10 JAERI      EVAL-MAR87 S.CHIBA
                      DIST-SEP89
HISTORY
87-03  NEWLY EVALUATED BY S.CHIBA (JAERI) FOR JENDL-3.
88-11  DATA FOR MF=3(MT=1,2,3,4,51,103,107,113,780,781) WERE
       MODIFIED.  DATA FOR MF=12(MT=102,781), MF=13(MT=4,103),
       MF=14(MT=4,102,103,781) WERE ADDED.  COMMENT WAS ALSO
       MODIFIED.

MF=1          GENERAL INFORMATION
  MT=451    DESCRIPTIVE DATA AND DICTIONARY

MF=2          RESONANCE PARAMETERS
  MT=151    SCATTERING RADIUS ONLY.
             THE 2200M/S AND 14 MEV CROSS SECTIONS ARE IN
             TABLE 1.

MF=3          NEUTRON CROSS SECTIONS
  MT=1      TOTAL
        BELOW 1.2 MEV, SUM OF THE PARTIAL CROSS SECTIONS.
        1.2 TO 17 MEV, BASED ON THE EXPERIMENTAL DATA /1/-/9/.
        ABOVE 17MEV, OPTICAL MODEL CALCULATION WAS NORMALIZED AT
         17 MEV. THE SPHERICAL OPTICAL POTENTIAL PARAMETERS/10/
         ARE LISTED IN TABLE 2.
  MT=2      ELASTIC SCATTERING
        BELOW 10 KEV, BASED ON THE R-MATRIX CALCULATION. THE
         R-MATRIX PARAMETERS ARE MAINLY BASED ON REF./11/.
        10 KEV TO 1.2 MEV, BASED ON THE EXPERIMENTAL DATA /12/-
         /14/.
        ABOVE 1.2 MEV, CALCULATED BY SUBTRACTING ALL THE OTHER
         PARTIAL CROSS SECTIONS FROM THE TOTAL CROSS SECTION.
  MT=3      NON-ELASTIC
        SUM OF MT=4, 16, 102, 103, 104, 107 AND 113.
  MT=4      TOTAL INELASTIC
        SUM OF MT=51 TO 89.
  MT=16     (N,2N)
        BASED ON THE EXPERIMENTAL DATA /15/. CROSS SECTION WAS
         EXTRAPOLATED AS 0.0120*SQRT(E-ETH), WHERE E IS INCIDENT
         NEUTRON ENERGY AND ETH THRESHOLD ENERGY IN MEV. NOTE
         THAT THIS REACTION PRODUCES 1 PROTON AND 2 ALPHA
         PARTICLES, I.E. (N,2NP)2ALPHA.
  MT=51-59, 61, 62, 64-66. INELASTIC SCATTERING TO REAL LEVELS
         CROSS SECTIONS WERE CALCULATED BY THE COLLECTIVE MODEL
          DWBA AND NORMALIZED TO THE EXPERIMENTAL DATA/16/ AT 14
          MEV. CALCULATED LEVELS AND ASSUMED ORBITAL ANGULAR
          MOMENTUM TRANSFERS (L) ARE SUMMARIZED IN TABLE 3.
         DATA FOR MT=51 WAS NORMALIZED TO THE EXPERIMENTAL
          DATA/17/ BELOW 6MEV.  ABOVE 6MEV, THE DEFORMATION
          PARAMETER DEDUCED FROM (P,P') REACTION/18/ WAS USED.
  MT=60,63,67-89 (N,N'D)2ALPHA CONTINUUM.
        REPRESENTED BY PSEUDO-LEVELS, BINNED IN 0.5 MEV INTERVALS.
         THE (N,N'D)2ALPHA CROSS SECTION WAS BASED ON THE
         MEASUREMENT OF FRYE+ /19/. THE CROSS SECTION FOR EACH
         LEVEL WAS CALCULATED BY THE 3-BODY PHASE SPACE
         DISTRIBUTION, ASSUMING ISOTROPIC CENTER-OF-MASS
         ANGULAR DISTRIBUTIONS.
  MT=102    CAPTURE
        1/V SHAPE WAS NORMALIZED TO THE EXPERIMENTAL DATA /20/.
  MT=103    (N,P)
        SUM OF MT = 700 TO 705.
  MT=104    (N,D)
        SUM OF MT = 720 AND 721.
  MT=107    (N,ALPHA)
        SUM OF MT = 780 AND 781. THE THERMAL CROSS SECTION OF
        3837 BARNS WAS ADOPTED/21/.
  MT=113    (N,T)2ALPHA
        BASED ON THE EXPERIMENTAL DATA /19/,/22/-/29/
  MT=251    MU-BAR
        CALCULATED FROM THE DATA IN FILE4.
  MT=700 (N,P) TO THE GROUND STATE OF BE-10.
        BELOW 100 KEV, ASSUMED TO BE 1/V. THE THERMAL CROSS
         SECTION WAS ASSUMED TO BE 3MB/30/.
        FROM 100 KEV TO 500 KEV, ASSUMED TO BE CONSTANT.
        FROM 500 KEV TO 1 MEV, LINEARLY INTERPOLATED.
        ABOVE 1 MEV, THE STATISTICAL MODEL CALCULATION WAS
         NORMALIZED BY A FACTOR OF 0.704.  THE OPTICAL POTENTIAL,
         LEVEL SCHEMES AND LEVEL DENSITY PARAMETERS USED IN THE
         CALCULATION ARE SUMMARIZED IN TABLES 2, 3 AND 4.
  MT=701-705 (N,P) TO THE LOW LYING EXCITED STATES OF BE-10.
        THE STATISTICAL MODEL CALCULATION WAS NORMALIZED TO THE
         EXPERIMENTAL DATA/26/ AT 14 MEV.
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  MT=720  (N,D0)
        BELOW 7.6 MEV, THE INVERSE REACTION CROSS SECTIONS/31/-
         /32/ WERE CONVERTED BY THE PRINCIPLE OF DETAILED
         BALANCE.
        FROM 7.6 TO 14 MEV, INTERPOLATED LINEARLY.
        ABOVE 14 MEV, DWBA CALCULATION WITH THE PROTON PICKUP
         MECHANISM WAS NORMALIZED TO THE EXPERIMENTAL DATA,
         /33/-/34/ AT 14 MEV. THE D + BE-9 AND BOUND PROTON
         POTENTIALS OF VALKOVIC+/34/ WERE USED. DEPTH OF THE
         PROTON POTENTIAL WAS SEARCHED BY THE SEPARATION ENERGY
         METHOD.  THE POTENTIAL PARAMETERS ARE LISTED IN TABLE 2.
  MT=721  (N,D2)
        DWBA CALCULATION WITH THE PROTON PICKUP MECHANISM WAS
         NORMALIZED TO THE EXPERIMENTAL DATA/26/,/33/-/34/ AT 14
         MEV. THIS IS REALLY THE (N,D) REACTION TO THE SECOND
         LEVEL OF BE-9.
  MT=780, (N,ALPHA0)
        BELOW 10 KEV, R-MATRIX CALCULATION.
        FROM 10 KEV TO 800 KEV, BASED ON THE EXPERIMENTAL DATA
         /35/-/36/.
        FROM 800 KEV TO 7.5 MEV, THE EXPERIMENTAL DATA/37/ WERE
         NORMALIZED BY A FACTOR OF 1.38 AND FITTED BY THE SPLINE
         FUNCTION.
        ABOVE 7 MEV, THE EXPERIMENTAL DATA/26/ WERE ADOPTED.
  MT=781  (N,ALPHA1)
        BELOW 10 KEV, THE R-MATRIX CALCULATION.
        FROM 10 KEV TO 100 KEV, BASED ON THE EXPERIMENTAL DATA/36/
         /38/.
        FROM 100 KEV TO 2 MEV, RECOMMENDATION BY LISKIEN AND
         WATTECAMPS/39/ WAS ADOPTED.
        FROM 2 TO 7.5 MEV, THE EXPERIMENTAL DATA/37-40/ WERE
         NORMALIZED BY A FACTOR OF 1.38 AND FITTED BY THE SPLINE
         FUNCTION.
        ABOVE 7 MEV, THE EXPERIMENTAL DATA/40/ WAS ADOPTED.

MF=4          ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2
        BELOW 100 KEV, THE R-MATRIX CALCULATION.
        FROM 100 KEV TO 6 MEV, ENDF/B-V WAS ADOPTED.
        ABOVE 6 MEV, BASED ON THE OPTICAL MODEL CALCULATION.
  MT=16
        CALCULATED BY THE METHOD OF NAKAGAWA/41/.
        ANGULAR DISTRIBUTIONS ARE GIVEN IN THE LABORATORY SYSTEM.
  MT=51-59, 61, 62, 64-66.
        DWBA CALCULATION.
  MT=60, 63, 67-89
        ASSUMED TO BE ISOTROPIC IN CM.

MF=5         ENERGY DISTRIBUTION OF SECONDARY NEUTRONS
  MT=16
        THE EVAPORATION MODEL WAS ASSUMED. THE EVAPORATION
         TEMPERATURE WAS ASSUMED TO BE 1 MEV AT 14 MEV. IT WAS
         EXTRAPOLATED AS
              T = 0.2673*SQRT(EN) MEV,
         WHERE EN MEANS THE INCIDENT NEUTRON ENERGY IN THE
         LABORATORY SYSTEM IN MEV.

MF=12        PHOTON MULTIPLICITIES
  MT=102
        MULTIPLICITIES WERE GIVEN ACCORDING TO A COMPILATION OF
         AJZENBERG ET AL./43/.  HOWEVER, THEY WERE NORMALIZED
         FOR THE TOTAL SECONDARY GAMMA-RAY ENERGY TO MATCH THE
         AVAILABLE ENERGY IN THE FINAL STATE.
  MT=781
        MULTIPLICITY FOR THE 0.478-MEV GAMMA-RAY WAS GIVEN AS
         1.0.

MF=13        PHOTON PRODUCTION CROSS SECTIONS
  MT=4
        EXPERIMENTAL DATA/41,44/ WERE ADOPTED FOR 0.4138-,
         0.7183- AND 1.0219-MEV GAMMA-RAYS.  FOR 1.44- AND
         2.15-MEV GAMMA-RAYS, EXCITATION FUNCTION OF THE
         0.4138-MEV GAMMA-RAY PRODUCTION WAS NORMALIZED TO THE
         DATA/41/ AT 14.8MEV.  FOR 2.87-, 3.01-, 4.44- AND
         6.03-MEV GAMMA-RAYS, SHAPES OF THE CORRESPONDING (N,N')
         EXCITATION FUNCTIONS IN MF=3 WERE NORMALIZED TO THE
         DATA/41/ AT 14.8MEV.
  MT=103
         FOR 3.368- AND 2.592-MEV GAMMA-RAYS, SHAPES OF THE
          CORRESPONDING (N,P) EXCITATION FUNCTIONS IN MF=3
          WERE NORMALIZED TO THE EXPERIMENTAL DATA/41/ AT
          14.8MEV.
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MF=14        ANGULAR DISTRIBUTION OF SECONDARY PHOTONS
  MT=4,102,103,113
        ASSUMED TO BE ISOTROPIC.
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TABLE 1 THE 2200-M/S AND 14 MEV CROSS SECTIONS

	2200-M/S (B)	14 MEV (B)
ELASTIC	2.144	0.943
(N,N')	-----	0.269
(N,P)	0.003	0.038
(N,D)	-----	0.047
(N,T)	0.012	0.095
(N,ALPHA)	3837.0	0.049
(N,2N)	-----	0.027
CAPTURE	0.50	0.000
TOTAL	3839.7	1.467

TABLE 2 OPTICAL POTENTIAL PARAMETERS

```
B-10 + N /10/
      V= 47.91 - 0.346EN, WS= 0.657 + 0.810EN, VSO=5.5  (MEV)
      R= 1.387          , RS= 1.336          , RSO=1.15 (FM)
      A= 0.464          , AS= 0.278          , ASO=0.5  (FM)

BE-10 + P /45/
      V  = 60.0 + 27.0(N-Z)/A -0.3ECM                   (MEV)
      WS = 0.64ECM + 10.0(N-Z)/A      ,(ECM < 13.8 MEV) (MEV)
         = 9.60-0.06ECM + 10.0(N-Z)/A ,(ECM > 13.8 MEV) (MEV)
      VSO= 5.5                                          (MEV)
```

R = RS = RSO = 1.15 (FM)
A = ASO = 0.57, AS= 0.5 (FM)

BE-9 + D /34/
V= 80.0 , WV= 30.0 , VSO=6.0 (MEV)
R= 1.0 , RV= 1.0 , RSO=1.0 ,RC= 1.3 (FM)
A= 1.0 , AV= 0.8 , ASO=1.0 (FM)

TABLE 3 LEVEL SCHEMES USED IN THE DWBA OR STATISTICAL MODEL CALCULATION

B-10				BE-10		
MT	ENERGY (MEV)	JP	L	MT	ENERGY (MEV)	JP
2	0.0	3+		700	0.0	0+
51	0.7183	1+	2	701	3.368	2+
52	1.7402	0+	4	702	5.958	2+
53	2.154	1+	2	703	5.960	1-
54	3.587	2+	2	704	6.179	0+
55	4.774	3+	2	705	6.263	2-
56	5.110	2-	3			
57	5.163	2+	2			
58	5.18	1+	2			
59	5.920	2+	2			
61	6.025	4+	2			
62	6.127	3-	3			
64	6.561	3+	2			
65	6.881	1-	3			
66	7.00	1+	2			
	7.430	1-				
	7.470	1+				
	7.477	2-				
	7.560	0+				
	7.670	1+				
	7.840	1-				
	8.070	2-				
	8.650	1+				
	8.890	3-				
	8.894	2+				

TABLE 4 LEVEL DENSITY PARAMETERS USED IN THE STATISTICAL MODEL CALCULATION

	A(1/MEV)	T(MEV)	C(1/MEV)	PAIR.(MEV)	EX(MEV)
B-10	1.196	5.581	0.066	0.0	16.17
BE-10	1.088	5.866	0.021	5.13	19.63

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MAT number =  528
  5-B - 11 JAERI       EVAL-MAY88 T.FUKAHORI
JAERI-M 89-046         DIST-SEP89
HISTORY
87-03  NEWLY EVALUATED BY T.FUKAHORI (JAERI)
88-05  REVISED BY T.FUKAHORI (JAERI)
       (N,D),(N,ND),(N,T),(N,NT) AND (N,N2A) ADDED

MF=1          GENERAL INFORMATION
  MT=451    DESCRIPTIVE DATA AND DICTIONARY

MF=2          RESONANCE PARAMETERS
  MT=151    ONLY SCATTERING RADIUS IS GIVEN.

MF=3          CROSS SECTIONS
  2200 M/SEC CROSS SECTIONS AND RESONANCE INTEGRALS
                       2200 M/SEC        RES. INTEG.
            TOTAL        5.050 B             -
            ELASTIC      5.045 B             -
            CAPTURE      5.075 MB          2.542 MB

  MT=1        TOTAL CROSS SECTION
        BELOW 1 MEV, CALCULATED WITH THE MULTI-LEVEL BREIT-WIGNER
        FORMULA AND THE RESONANCE PARAMETERS TAKEN FROM REF. /1/.
        IN THE RANGE OF 1 TO 4 MEV, BASED ON THE R-MATRIX
        CALCULATION WHICH WAS PERFORMED BY USING KOEHLER ET AL.'S
        PARAMETERS /2/. ABOVE 4 MEV, SMOOTH CURVE WAS OBTAINED BY
        FITTING TO THE EXPERIMENTAL DATA OF AUCHAMPAUGH ET AL./3/.
  MT=2        ELASTIC SCATTERING CROSS SECTION
        BELOW 1 MEV BASED ON THE MULTI-LEVEL BREIT-WIGNER FORMULA.
        IN THE RANGE OF 1 TO 2.2 MEV, THE R-MATRIX CALCULATION WAS
        ADOPTED. ABOVE 2.2 MEV, THE CROSS SECTION WAS OBTAINED BY
        SUBTRACTING THE REACTION CROSS SECTIONS FROM THE TOTAL
        CROSS SECTION.
  MT=4        TOTAL INELASTIC SCATTERING CROSS SECTION
        SUM OF MT=51-57 AND 91.
  MT=16       (N,2N)B-10 CROSS SECTION
        CALCULATED WITH GNASH /4/. THE OPTICAL POTENTIAL
        PARAMETERS, THE LEVEL DENSITY PARAMETERS AND THE LEVEL
        SCHEME ARE SHOWN IN TABLES 1-3, RESPECTIVELY.
  MT=22       (N,N'ALPHA)LI-7 CROSS SECTION
        CALCULATED WITH GNASH. THE OPTICAL POTENTIAL PARAMETERS,
        THE LEVEL DENSITY PARAMETERS AND THE LEVEL SCHEME ARE
        SHOWN IN TABLES 1-3, RESPECTIVELY.
  MT=28       (N,N'P)BE-10 CROSS SECTION
        BASED ON THE GNASH CALCULATION. THE PARAMETERS USED ARE
        LISTED IN TABLES 1-3.
  MT=29       (N,N'2ALPHA)T CROSS SECTION
        BASED ON (N,N'T) CROSS SECTION OF THE GNASH CALCULATION
        AND NORMALIZED TO HE PRODUCTION CROSS SECTION OF KNEFF
        ET AL. /5/.
  MT=32       (N,N'D)BE-9 CROSS SECTION
        BASED ON THE GNASH CALCULATION. THE PARAMETERS USED ARE
        LISTED IN TABLES 1-3.
  MT=33       (N,N'T)BE-8 CROSS SECTION
        BASED ON THE GNASH CALCULATION. THE PARAMETERS USED ARE
        LISTED IN TABLES 1-3.
  MT=51       INELASTIC SCATTERING
        THE R-MATRIX CALCULATION WITH KOEHLER ET AL.'S PARAMETERS
        WAS ADOPTED BELOW 7 MEV. ABOVE 7 MEV, THE GNASH AND DWBA
        CALCULATIONS WERE PERFORMED. THE SUM OF BOTH RESULTS
        WAS ADOPTED, AND NORMALIZED TO THE EXPERIMENTAL DATA OF
        KOEHLER ET AL. /2/ AND GLENDINNING ET AL. /6/.
  MT=52,53    INELASTIC SCATTERING
        BELOW 7 MEV, BASED ON THE R-MATRIX CALCULATION WITH
        THE SEARCHED PARAMETERS. ABOVE 7 MEV, THE SUM OF THE GNASH
        AND DWBA CALCULATIONS WAS ADOPTED, AND FITTED TO THE
        EXPERIMENTAL DATA OF GLENDINNING ET AL..
  MT=54-57    INELASTIC SCATTERING
        THE SUM OF RESULTS OF THE GNASH AND DWBA CALCULATIONS WAS
        NORMALIZED TO BE THE RESULT OF OKTAVIAN'S DDX DATA /7/.
  MT=91       CONTINUUM INELASTIC SCATTERING
        ABOVE 7.2 MEV, CONTINUUM LEVELS WERE ADOPTED.
        BASED ON THE GNASH CALCULATION.
  MT=102      CAPTURE CROSS SECTION
        CALCULATED FROM THE MULTI-LEVEL BREIT-WIGNER FORMULA.
        THE DIRECT CAPTURE /1/ IS ALSO CONSIDERED.
  MT=103      (N,P)BE-11 CROSS SECTION
        BASED ON THE GNASH CALCULATION WITH BEING NORMALIZED TO
        THE EXPERIMENTAL DATA OF STEPANCIC ET AL. /8/. THE
        PARAMETERS USED ARE SHOWN IN TABLES 1-3, RESPECTIVELY.
  MT=104      (N,D)BE-10 CROSS SECTION
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BASED ON THE GNASH CALCULATION.
MT=105 (N,T)BE-9 CROSS SECTION
BASED ON THE GNASH CALCULATION.
MT=107 (N,ALPHA)LI-8 CROSS SECTION
THE GNASH CALCULATION WAS PERFORMED, AND NORMALIZED TO THE EXPERIMENTAL DATA OF ANTOLKOVIC ET AL. /9/ AND SCOBEL ET AL. /10/. THE PARAMETERS USED ARE SHOWN IN TABLES 1-3, RESPECTIVELY.
MT=251 MU-BAR
CALCULATED FROM THE DATA IN MF=4.

MF=4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=2
THE R-MATRIX AND DWBA CALCULATIONS WERE ADOPTED BELOW 8 MEV AND ABOVE 8 MEV, RESPECTIVELY.
MT=16,22,28,29,32,33,91
ASSUMED TO BE ISOTROPIC IN THE CENTER OF MASS SYSTEM.
MT=51,52,53
BELOW 8 MEV BASED ON R-MATRIX CALCULATION. ABOVE 8 MEV, BASED ON THE DWBA AND THE GNASH CALCULATIONS.
MT=54,55,56,57
BASED ON THE DWBA AND THE GNASH CALCULATIONS.

MF=5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=16,22,28,29,32,33,91
BASED ON THE GNASH CALCULATION.

MF=12-15 GAMMA-RAY DATA
BASED ON THE GNASH CALCULATION.

TABLE 1 THE OPTICAL POTENTIAL PARAMETERS

NEUTRON	V = 41.8-0.005E	MEV*	R0= 1.40 FM	A0= 0.35 FM	REF.12
	WS= 1.01E	MEV*	RI= 1.15 FM*	AI= 0.50 FM	
PROTON	V = 66.1-0.273E	MEV	R0= 1.15 FM	A0= 0.57 FM	REF.13
	WS= 1.50+0.581E	MEV	RI= 1.15 FM	AI= 0.5 FM	
	VSYM = 5.5	MEV	R0= 1.15 FM	A0= 0.57 FM	
DEUTERON	V = 80.0	MEV*	R0= 1.0 FM*	A0= 1.0 FM*	REF.14
	WV= 30.0	MEV	RI= 1.0 FM*	AI= 0.8 FM*	
	VSYM = 6.0	MEV*	R0= 1.0 FM*	A0= 1.0 FM*	
TRITON	V = 103.0+20.0E	MEV*	R0= 0.85 FM	A0= 0.70 FM	REF.15
	WV= 1.49E	MEV*	RI= 2.06 FM	AI= 0.72 FM	
	VSYM = 8.55	MEV*	R0= 0.85 FM	A0= 0.70 FM	
ALPHA	V = 285.2-2.40E	MEV*	R0= 1.61 FM*	A0= 0.55 FM*	REF.16
	WS= 16.16-0.70E	MEV*	RI= 1.81 FM	AI= 0.65 FM	

NOTE : E IS INCIDENT NEUTRON ENERGY IN LAB. SYSTEM.
* MEANS THAT PARAMETER IS MODIFIED FROM ORIGINAL ONE.

TABLE 2 THE LEVEL DENSITY PARAMETERS

	A(1/MEV)	T(MEV)	PAIR.(MEV)
B-10	1.196	7.990	0.0
B-11	1.431	6.112	2.67
B-12	1.491	6.201	0.0
BE-8	1.115	9.187	5.13
BE-9	1.125	8.248	2.46
BE-10	1.088	10.029	5.13
BE-11	1.419	7.277	2.46
LI-7	1.138	7.197	2.67
LI-8	1.115	8.170	0.0

TABLE 3 THE LEVEL SCHEME (ENERGY(MEV), SPIN AND PARITY) /17-18/

	B-10		B-11		BE-10		BE-11		LI-7		LI-8	
GS	0.0	3+	0.0	3/2-	0.0	0+	0.0	1/2+	0.0	3/2-	0.0	2+
1	0.718	1+	2.125	1/2-	3.368	2+	0.320	1/2-	0.478	1/2-	0.981	1+
2	1.740	0+	4.445	5/2-	5.958	2+			4.630	7/2-		
3	2.154	1+	5.020	3/2-	5.960	1-			6.680	5/2-		
4	3.587	2+	6.743	7/2-	6.179	0+			7.460	5/2-		
5	4.774	3+	6.792	1/2+	6.263	2-			9.670	7/2-		
6	5.110	2-	9.120	7/2+	7.371	3-			9.850	3/2-		
7	5.164	2+	10.60	7/2+	7.452	2+			11.240	3/2-		
8	5.180	1+			9.270	4-						
9	5.926	2+			9.400	2+						

10	6.025	4+
11	6.127	3-
12	6.561	4-
13	6.873	1-
14	7.002	2+
15	7.430	2-
16	7.467	1+
17	7.479	2+
18	7.561	0+
19	7.670	1+
20	7.819	1-
21	8.070	2+
22	8.700	2+
23	8.889	3-
24	8.895	2+

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MAT number =  625
  6-C - 12 JAERI       EVAL-AUG83 K.SHIBATA
 JAERI-M 83-221        DIST-SEP89 REV2-DEC93
HISTORY
83-08   NEWLY EVALUATED BY K.SHIBATA
        DETAILS OF THE EVALUATION ARE GIVEN IN REF./1/.
84-07   DATA OF MF=4 MT=91 WERE REVISED.
        COMMENT WAS ALSO MODIFIED.
85-02   DATA OF MT=2, 3, 4, 53 OF MF=3 WERE REVISED ABOVE 10.45
        MEV.  ANGULAR DISTRIBUTIONS FOR MT=52, 53 WERE ALSO
        REVISED.
88-07   DATA OF MT=1, 3, 4, 52 OF MF=3 WERE REVISED ABOVE 8.3 MEV.
93-12   JENDL-3.2
        INELASTIC SCATTERING AND CAPTURE CROSS SECTIONS WERE
        REEVALUATED BY K. SHIBATA (JAERI).
        PSEUDO LEVELS WERE GENERATED TO REPRODUCE VAILABLE DDX
        DATA.
        THE TOTAL CROSS SECTION WAS REPLACED WITH THE R-MATRIX
        CALCULATION DONE IN REF./1/.
        ALL DATA WERE COMPILED BY K. SHIBATA.
        *****  MODIFIED PARTS FOR JENDL-3.2 *******************
        (3,1)      R-MATRIX CALCULTION/1/.
        (3,2)      TOTAL - NOELASTIC
        (3,3)      SUM OF PARTIAL REACTION CROSS SECTIONS
        (3,4)      SUM OF (3,51-91)
        (3,51)     MODIFIED BY CONSIDERING EXPERIMENTAL DATA.
        (3,53),(3,58)
                   COUPLED-CHANNEL STATISTICAL MODEL CAL.
        (3,52),(3,54-57),(3,59-75)
                   PSEUDO LEVELS.
        (3,91)     4-BODY BREAKUP.
        (3,102)    MODIFIED BY TAKING ACCOUNT OF P-WAVE CAPTURE.
        (4,51-91)
        (5,91)     4-BODY PHASE SPACE
        (12,102)   EXPERIMENTAL DATA FOR 20-200 KEV.
        ******************************************************
MF=1           GENERAL INFORMATION
  MT=451    DESCRIPTIVE DATA

MF=2           RESONANCE PARAMETERS
  MT=151    SCATTERING RADIUS ONLY.

MF=3           CROSS SECTIONS
            CALCULATED 2200M/S CROSS SECTIONS AND RES. INTEGRALS
               2200M/S (B)       RES.INTEG. (B)
    TOTAL      4.750                 -
    ELASTIC    4.746                 -
    CAPTURE    0.0035              0.0018

  MT=1      SIG-T
         BELOW 10 EV, SUM OF SIG-EL AND SIG-CAP.
         BETWEEN 10 EV AND 4.8 MEV, THE CROSS SECTION WAS CALCU-
         LATED ON THE BASIS OF THE R-MATRIX THEORY.  THE R-MATRIX
         PARAMETERS WERE OBTAINED SO AS TO GIVE THE BEST FIT TO
         THE EXPERIMENTAL DATA /2/-/7/.
         ABOVE 4.8 MEV, BASED ON THE MEASUREMENTS /8/-/10/.
  MT=2      SIG-EL
         BELOW 10 EV, SIG-EL = 4.746 BARNS.
         ABOVE 10 EV, THE CROSS SECTION WAS OBTAINED BY SUBTRACTING
         THE REACTION CROSS SECTION FROM THE TOTAL CROSS SECTION.
  MT=3      NON-ELASTIC
         SUM OF MT=4, 102, 103, 104 AND 107.
  MT=4      TOTAL INELASTIC
         SUM OF MT=51-75 AND 91.
  MT=51     SIG-IN  4.44 MEV LEVEL
         BASED ON THE EXPERIMENTAL DATA /11,27,30,31/.
  MT=53,58 SIG-IN  7.65 MEV (0+), 9.64 MEV (3-) LEVELS
         THE CROSS SECTIONS WERE OBTAINED FROM COUPLED-CHANNEL
         AND STATISTICAL MODEL CALCULATIONS.
  MT=52,54-57,59-75  PSEUDO LEVELS (N,N'3ALPHA)
         PSEUDO LEVELS WITH AN INTERVAL OF 500 KEV WERE MADE IN
         ORDER TO SIMULATE SEQUENTIAL (N,N') DECAY (EVAPORATION
         SHAPE) AND 3-BODY BREAKUP (PHASE SPACE) LEADING TO
         (N,N'3ALPHA).  THE SUM OF THE CROSS SECTIONS FOR PSEUDO
         LEVELS AND MT=91 IS CONSISTENT WITH THE MEASUREMENT/12/
         EXCEPT AROUND THE THRESHOLD ENERGY WHERE THE CALCULATED
         CROSS SECTIONS WERE ENHANCED.
  MT=91     (N,N'3ALPHA)
         CONTRIBUTION FROM 4-BODY BREAKUP.  THE CROSS SECTION
         WAS ADJUSTED SO THAT THE CALCULATED SPECTRUM COULD GIVE
         A GOOD FIT TO EXPERIMENTAL DATA AT 14 MEV.
         TOTAL (N,N')3A CROSS SECTION IS THE SUM OF MT=52-75
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        AND 91.
  MT=102   CAPTURE
        BELOW 100 EV, 1/V CURVE.
        BETWEEN 100 EV AND 5 MEV, S-WAVE PLUS P-WAVE CAPTURE
        BY CONSIDERING THE DATA OF IGASHIRA/32/.
        ABOVE 5 MEV, THE INVERSE REACTION DATA OF COOK /13/ WERE
        ADDED.
  MT=103   (N,P)
        BASED ON THE MEASUREMENT OF RIMMER AND FISHER /14/.
  MT=104   (N,D)
        CALCULATED WITH DWBA.
  MT=107   (N,A)
        BASED ON THE EXPERIMENTAL DATA /15/-/23/.
  MT=251   MU-BAR
        CALCULATED FROM THE DATA IN FILE4.

MF=4          ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2
        BELOW 10 EV, ISOTROPIC IN THE CENTER-OF-MASS SYSTEM (CM).
        BETWEEN 10 EV AND 4.8 MEV, CALCULATED WITH THE R-MATRIX
        THEORY.
        ABOVE 4.8 MEV, BASED ON THE EXPERIMENTAL DATA /24/-/28/.
  MT=51
        BASED ON THE EXPERIMENTAL DATA /24/-/28//33/.
  MT=53, 58
        BASED ON THE EXPERIMENTAL DATA /33/.
  MT=52,54-57,59-75
        ISOTROPIC IN CM.
  MT=91
        ISOTROPIC DISTRIBUTIONS IN LAB.

MF=5          ENERGY DISTRIBUTION OF SECONDARY NEUTRONS
  MT=91
        4-BODY PHASE SPACE.

MF=12         PHOTON-PRODUCTION MULTIPLICITIES
  MT=51    (N,N')GAMMA
        M=1.0
  MT=102    (N,GAMMA)
        BASED ON THE MEASUREMENT OF SPILLING ET AL./29/ AND
        OF IGASHIRA /32/.

MF=14         PHOTON ANGULAR DISTRIBUTIONS
  MT=51
        BASED ON THE EXPERIMENTAL DATA OF MORGAN ET AL./11/.
  MT=102
        ASSUMED TO BE ISOTROPIC.
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MAT number =  725
  7-N - 14 JNDC        EVAL-JUN89 Y.KANDA(KYU) T.MURATA(NAIG)+
                       DIST-SEP89 REV2-FEB94
HISTORY
89-06  NEW EVALUATION FOR JENDL-3
        SUB-WORKING GROUP ON EVALUATION OF N-14,
        WORKING GROUP ON NUCLEAR DATA FOR FUSION,
        JAPANESE NUCLEAR DATA COMMITTEE
       IN CHARGE
        SIG-T       K.SHIBATA (JAERI)
        SIG-EL      T.ASAMI (NEDAC), T.MURATA (NAIG)
        SIG-IN      T.AASMI, T.MURATA
        (N,2N),(N,P),(N,T),(N,A)
                    Y.KANDA(KYU)
        (N,NA),(N,AP),(N,ND),(N,D)
                    T.ASAMI
        CAPTURE     T.ASAMI
        PHOTON PRODUCTION
                    T.ASAMI
       COMPILATION
        EVALUATED DATA WERE COMPILED BY T.FUKAHORI (JAERI).
90-10  MF=5: SPECTRA WERE MODIFIED AT LOW ENERGIES OF EMITTED
       NEUTRONS BY T.ASAMI(DATA ENGINEERING CO. LTD.)
90-11  REEVALUATION WAS MADE FOR THE DATA CONCERNING WITH THE
       NEUTRON EMISSION DOUBLE DIFFERENTIAL CROSS SECTIONS.
        THE INELASTIC SCATTERING CROSS SECTIONS AND THE ANGULAR
       DISTRIBUTIONS FOR THE INELASTICALLY EMITTED NEUTRONS WERE
       REVISED CONSIDERABLY/25/.
94-02  JENDL-3.2
        MF=3, MT=1,2,4,22,32,52-90,103,105: CROSS SECTION MODIFIED
       AND MF=4, MT=54-90: ISOTOROPIC ANGULAR DIST. ADDED
       BY T.FUKAHORI(JAERI).
        MF=12,MT=102: MULTIPLICITY MODIFIED
       BY K.SHIBATA (JAERI).

       *****  MODIFIED PARTS FOR JENDL-3.2  **********************
       (3,1),(3,2)            ABOVE 1 MEV
       (3,4),(3,22),(3,32)    ALL ENERGY REGION
       (3,52-71)              9-14 MEV
       (3,72)                 (3,72)+(3,73) OF JENDL-3.1
       (3,73)                 (3,74) OF JENDL-3.1
       (3,74-90)              NEW PSEUD-LEVEL ADDED
       (3,103)                ABOVE 7 MEV
       (3,105)                ABOVE 9 MEV
       (4,74-90)              NEW PSEUD-LEVEL ADDED
       (12,102)               ENERGY BALANCE
       ***********************************************************

MF=1          GENERAL INFORMATION
  MT=451    DESCRIPTIVE DATA

MF=2          RESONANCE PARAMETERS
  MT=151    SCATTERING RADIUS ONLY.

MF=3          CROSS SECTIONS
            CALCULATED 2200 M/S CROSS SECTIONS AND RES. INTEG.
                   2200 M/S (B)       RES. INTEG. (B)
       TOTAL        11.851                -
       ELASTIC      10.007                -
       CAPTURE      0.075               0.0034

  MT=1      SIG-T
          BELOW 1 EV, A SUM OF PARTIAL CROSS SECTIONS.
          ABOVE 1 EV, BASED ON THE EXPERIMENTAL DATA /1,2,3,4/.
  MT=2      SIG-EL
          BELOW 1 EV, SIG-EL = 10 BARNS.
          ABOVE 1 EV, THE ELASTIC SCATTERING CROSS SECTION WAS
          OBTAINED BY SUBTRACTING THE REACTION CROSS SECTIONS FROM
          THE TOTAL CROSS SECTION.
  MT=4      TOTAL INELASTIC
          SUM OF MT=51 TO 91.
  MT=16     (N,2N)
          BASED ON EXPERIMENTAL DATA/5/-/7/.
  MT=22     (N,N ALPHA)
          ADOPTED THE HALF OF VALUES CALCULATED WITH THE GNASH
          CODE/8/.
  MT=28     (N,NP)
          CALCULATED WITH THE GNASH CODE/8/, AND NORMALIZED
          TO THE EXPERIMENTAL DATA/9/.
  MT=32     (N,ND)
          ADOPTED THE HALF OF VALUES CALCULATED WITH THE GNASH
          CODE/8/.
```

MT=51-90 SIG-IN

THE CROSS SECTIONS WERE CALCULATED WITH THE STATISTICAL MODEL. THE LOW-ENERGY PORTION WAS ANALYZED WITH THE RESONANCE THEORY/10/. FOR MT=51 TO 73, THE DIRECT COMPONENTS WERE CALCULATED WITH THE DWUCK CODE/26/. FOR 74 TO 90, PSEUD-LEVELS WERE ASSUMED AND ADJUSTED TO FIT TO THE EXPERIMENTAL DATA/27/.
THE OPTICAL POTENTIAL PARAMETERS USED ARE THE FOLLOWING /11/:

```
V = 50.08-0.01E ,  WS = 9.0 + 0.62E,  VSO = 5.5  (MEV)
R = 1.22        ,  RS = 1.45       ,  RSO = 1.15 (FM)
A = 0.66        ,  B  = 0.13       ,  ASO = 0.50 (FM).
```

LEVEL SCHEME

NO.	ENERGY(MEV)	SPIN-PARITY	
G.S.	0.0	1 +	
1.	2.3129	0 +	
2.	3.9478	1 +	
3.	4.9150	0 -	
4.	5.1059	2 -	
5.	5.6900	1 -	
6.	5.8320	3 -	
7.	6.2040	1 +	
8.	6.4440	3 +	
9.	7.0280	2 +	
10.	7.9670	2 -	
11.	8.0620	1 -	
12.	8.4880	4 -	
13.	8.6180	0 +	
14.	8.7900	0 -	
15.	8.91	3 -	
16.	8.96	5 +	
17.	9.13	3 +	
18.	9.17	2 +	
19.	9.51	2 -	
20.	10.23	1 -	
21.	10.81	5 +	
22.	11.05	3 +	
	11.07	1 +	(SUMMING UP)
23.	11.24	3 -	
24.	11.5		(PSEUD-LEVEL)
25.	11.75		(PSEUD-LEVEL)
26.	12.0		(PSEUD-LEVEL)
27.	12.25		(PSEUD-LEVEL)
28.	12.5		(PSEUD-LEVEL)
29.	13.0		(PSEUD-LEVEL)
30.	13.5		(PSEUD-LEVEL)
31.	14.0		(PSEUD-LEVEL)
32.	14.5		(PSEUD-LEVEL)
33.	15.0		(PSEUD-LEVEL)
34.	15.5		(PSEUD-LEVEL)
35.	16.0		(PSEUD-LEVEL)
36.	16.5		(PSEUD-LEVEL)
37.	17.0		(PSEUD-LEVEL)
38.	17.5		(PSEUD-LEVEL)
39.	18.0		(PSEUD-LEVEL)
40.	18.5		(PSEUD-LEVEL)

MT=102 CAPTURE

CALCULATED WITH THE CASTHY CODE/12/.

MT=103 (N,P)

BELOW 7 MEV, BASED ON EXPERIMENTAL DATA/13/-/18/.
ABOVE 7 MEV, BASED ON EXPERIMENTAL DATA/28/.

MT=104 (N,D)

BELOW 8.5 MEV, BASED ON EXPERIMENTAL DATA/19/.
ABOVE 8.5 MEV, CALCULATED WITH GNASH.

MT=105 (N,T)

BELOW 9 MEV, BASED ON EXPERIMENTAL DATA/20/.
ABOVE 9 MEV, BASED ON EXPERIMENTAL DATA/29/-/30/.

MT=107 (N,ALPHA)

BASED ON THE EXPERIMENTAL DATA/17/-/20/.

MT=108 (N,2ALPHA)

CALCULATED WITH GNASH AND NORMALIZED AT 14.1 MEV TO AN AVERAGE VALUE AMONG THE EXPERIMENTAL DATA/21/-/22/.

MT=251 MU-BAR

CALCULATED FROM ANGULAR DISTRIBUTIONS IN MF=4.

MT=780 (N, ALPHA0)

BASED ON EXPERIMENTAL DATA.

MT=781 (N, ALPHA1)

BASED ON EXPERIMENTAL DATA.

MT=798 (N, ALPHA) CONTINUUM

BASED ON EXPERIMENTAL DATA.

MF=4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS

```
  MT=2
         1.E-5 EV TO 8 MEV  CALCULATED WITH THE RESONANCE THEORY.
         8 MEV TO 20 MEV    CALCULATED WITH CASTHY.
  MT=16,22,28,32
         ASSUMED TO BE ISOTROPIC IN THE CENTER OF MASS SYSTEM.
  MT=51-73
         CALCULATED WITH CASTHY/12/ AND DWUCK/26/.
  MT=74-90
         ASSUMED TO BE ISOTROPIC IN THE LABORATORY SYSTEM.

MF=5          ENERGY DISTRIBUTION FOR SECONDARY NEUTRONS
  MT=16,22,28,32
         CALCULATED WITH THE GNASH CODE/8/.

MF=12         PHOTON PRODUCTION MULTIPLICITIES
  MT=102,103
         CALCULATED WITH THE GNASH CODE.
         FOR MT=102, MODIFIED BY CONSIDERING ENERGY BALANCE.

MF=13         PHOTON PRODUCTION CROSS SECTIONS
  MT=3
         CALCULATED WITH THE GNASH CODE/8/.

MF=14         PHOTON ANGULAR DISTRIBUTIONS
  MT=3,102,103
         ISOTROPIC

MF=15         PHOTON ENERGY DISTRIBUTIONS
  MT=3,102,103
         CALCULATED WITH THE GNASH CODE/8/.
         FOR MT=102, MODIFIED BY USING THE EXPERIMENTAL DATA/24/
         AT THERMAL ENERGY.
```

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MAT number = 728

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  7-N - 15 JAERI        EVAL-DEC88 T.FUKAHORI
JAERI-M 89-047          DIST-SEP89 REV2-APR94
HISTORY
88-12 NEWLY EVALUATED BY T.FUKAHORI (JAERI)/1/
94-04 JENDL-3.2
      COMPILED BY T.FUKAHORI AND K.SHIBATA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      ( 2,151) OMITTED EXCEPT SCATTERING RADIUS
      ( 3,  1) BELOW 5.5 MEV, CHANGED TO POINT-WISE CROSS SECTION
      ( 3,  2) BELOW 5.5 MEV, CHANGED TO POINT-WISE CROSS SECTION
      ( 3,102) BELOW 5.5 MEV, CHANGED TO POINT-WISE CROSS SECTION
      (12,102) FROM ENERGY BALANCE
     ***********************************************************


MF=1          GENERAL INFORMATION
  MT=451    DESCRIPTIVE DATA AND DICTIONARY

MF=2          RESONANCE PARAMETERS
  MT=151    ONLY SCATTERING RADIUS IS GIVEN.

  2200 M/SEC CROSS SECTIONS AND RESONANCE INTEGRALS
                         2200 M/SEC         RES. INTEG.
            TOTAL          4.590 B               -
            ELASTIC        4.590 B               -
            CAPTURE        0.024 MB          0.016 MB

MF=3          CROSS SECTIONS
  MT=1      TOTAL CROSS SECTION
        BELOW 5.5 MEV, RESONANCE PARAMETERS OF THE MULTI-LEVEL
        BREIT-WIGNER FORMULA /2,3/ ARE ADJUSTED TO REPRODUCE THE
        EXPERIMENTAL DATA OF B.ZEITNITZ ET AL./4/, AND GIVEN AS
        POINT-WISE DATA.  ABOVE 5.5 MEV, SMOOTH CURVE WAS OBTAINED
        BY FITTING TO THE EXPERIMENTAL DATA OF B.ZEITNITZ ET AL.
  MT=2      ELASTIC SCATTERING CROSS SECTION
        BELOW 5.5 MEV, POINT-WISE CROSS SECTION OBTAINED FROM MLBW
        CALCULATION IS GIVEN.  ABOVE 5.5 MEV, THE CROSS SECTION
        WAS OBTAINED BY SUBTRACTING THE REACTION CROSS SECTIONS
        FROM THE TOTAL CROSS SECTION.
  MT=4      TOTAL INELASTIC SCATTERING CROSS SECTION
        SUM OF MT=51-66 AND 91.
  MT=16,22,28,32,33,103,104,105,107
        CALCULATED WITH GNASH /5/. THE OPTICAL POTENTIAL POTENTIAL
        PARAMETERS, THE LEVEL DENSITY PARAMETERS AND THE LEVEL
        SCHEME ARE SHOWN IN TABLES 1-3, RESPECTIVELY.
  MT=51-91  INELASTIC SCATTERING
        CALCULATED WITH CASTHY /6/. THE PARAMETERS ARE ALSO SHOWN
        IN TABLES 1-3.
  MT=102    CAPTURE CROSS SECTION
        BELOW 5.5 MEV, POINT-WISE CROSS SECTION OBTAINED FROM MLBW
        CALCULATION IS GIVEN.  ABOVE 5.5 MEV, THE CROSS SECTION
        WAS OBTAINED BY CASTHY CALCULATION.
  MT=251    MU-BAR
        CALCULATED FROM THE DATA IN MF=4.

MF=4           ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,51-66
        BASED ON THE CASTHY CALCULATION.
  MT=16,22,28,32,33,91
        ASSUMED TO BE ISOTROPIC IN THE CENTER OF MASS SYSTEM.

MF=5          ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,22,28,32,33,91
        BASED ON THE GNASH CALCULATION.

MF=12-15      GAMMA-RAY DATA
        BASED ON THE GNASH CALCULATION.  FOR MF=12,MT=102,
        MODIFICATION WAS DONE FOR ENERGY BALANCE.

         TABLE 1   THE OPTICAL POTENTIAL PARAMETERS
------------------------------------------------------------------
 NEUTRON  V   = 50.08-0.012E MEV   R0 = 1.22 FM   A0 = 0.66 FM
          WS  =  8.91+0.618E MEV   RI = 1.45 FM   AI = 0.13 FM
          VSYM=  5.50        MEV   R0 = 1.15 FM   A0 = 0.50 FM

 PROTON   V   = 51.30-0.220E MEV   R0 = 1.21 FM   A0 = 0.61 FM
          WS  =  6.40-0.050E MEV   RI = 1.03 FM   AI = 0.53 FM
          VSYM=  6.00        MEV   R0 = 1.06 FM   A0 = 0.53 FM

 DEUTERON  PEREY-PEREY'S POTENTIAL/7/
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TRITON	BECCHETTI-GREENLEES'S POTENTIAL/8/				
ALPHA	V = 43.9	MEV	R0 = 1.91 FM	A0 = 0.45 FM
	WV = 3.85	MEV	RI = 1.91 FM	AI = 0.45 FM

TABLE 2 THE LEVEL DENSITY PARAMETERS

	A(1/MEV)	T(MEV)	PAIR.(MEV)	EX(MEV)
B-11	1.431	6.149	2.67	25.58
B-12	1.491	6.201	0.0	26.78
C-12	1.700	5.971	5.60	37.91
C-13	1.846	5.382	2.80	30.57
C-14	1.988	4.887	5.00	28.94
C-15	1.988	4.600	0.0	19.28
N-14	1.600	5.000	0.0	10.00
N-15	2.130	3.758	2.20	10.07
N-16	2.130	4.547	0.0	22.11

TABLE 3 THE LEVEL SCHEME (ENERGY(MEV), SPIN AND PARITY)/3,9,10/

	N-14		N-15		N-16		C-15		C-14		C-13	
GS	0.0	1+	0.0	1/2-	0.0	2-	0.0	1/2+	0.0	0+	0.0	1/2-
1	2.313	0+	5.270	5/2+	0.120	0-	0.740	5/2+	6.094	1-	3.089	1/2+
2	3.948	1+	5.299	1/2+					6.589	0+	3.685	3/2-
3	4.915	0-	6.324	3/2-					6.728	3-	3.854	5/2+
4	5.106	2-	7.155	5/2+					6.903	0-		
5	5.691	1-	7.301	3/2+					7.012	2+		
6	5.834	3-	7.567	7/2+					7.341	2-		
7	6.204	1+	8.313	1/2+								
8	6.446	3+	8.571	3/2+								
9	7.029	2+	9.050	1/2+								
10			9.152	3/2-								
11			9.155	5/2+								
12			9.225	1/2-								
13			9.758	5/2-								
14			9.829	7/2-								
15			9.928	3/2-								
16			10.070	3/2+								

	C-12		B-11		B-12	
GS	0.0	0+	0.0	3/2-	0.0	1+
1			2.125	1/2-	0.953	2+
2			4.445	5/2-	1.674	2-
3			5.020	3/2-	2.620	1-
4			6.743	7/2-	2.720	0+
5			6.793	1/2+		
6			7.286	5/2+		

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MAT number = 825

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  8-O - 16 JNDC        EVAL-DEC83 Y.KANDA(KYU) T.MURATA(NAIG)+
 JAERI-M 90-012        DIST-SEP89 REV2-DEC93
HISTORY
83-12  NEW EVALUATION FOR JENDL-3
        SUB-WORKING GROUP ON EVALUATION OF O-16,
        WORKING GROUP ON NUCLEAR DATA FOR FUSION,
        JAPANESE NUCLEAR DATA COMMITTEE
       IN CHARGE
        SIG-T         Y.NAKAJIMA K.SHIBATA(JAERI)
        SIG-EL        T.MURATA(NAIG)
        SIG-IN        S.TANAKA(JAERI)
        CAPTURE       T.ASAMI(JAERI)
        (N,2N),(N,P),(N,D),(N,ALPHA)    Y.KANDA(KYU)
       COMPILATION
        EVALUATED DATA WERE COMPILED BY K.SHIBATA.
84-07  DATA OF MF=4 (MT=16,91) WERE REVISED.
       COMMENT WAS ALSO MODIFIED.
87-01  DATA OF MF=3 (MT=51-64,67), MF=4 (MT=51-55) AND MF=5(MT=16)
       WERE MODIFIED (S.CHIBA, JAERI). COMMENT WAS ALSO MODIFIED.
90-10  MF=5 (EXCEPT MT=91), MF=12, MT=102 MODIFIED.
93-12  CAPTURE AND GAMMA PRODUCTION CROSS SECTIONS WERE MODIFIED.
*****  MODIFIED PARTS FOR JENDL-3.2 ****************************
(3,102)          REEVALUATED BY K. SHIBATA.
(3,2),(3,3)      RECALCULATED
(12,102)         MODIFIED DUE TO ENERGY CONSERVATION
(12,51;57;62)    510 KEV GAMMAS INCORPORATED
(13,3)           REEVALUATED BY T. ASAMI (DE)
****************************************************************

MF=1           GENERAL INFORMATION
  MT=451   DESCRIPTIVE DATA

MF=2           RESONANCE PARAMETERS
  MT=151   SCATTERING RADIUS ONLY.

MF=3           CROSS SECTIONS
           CALCULATED 2200M/S CROSS SECTIONS AND RES. INTEGRALS
                 2200M/S (B)       RES. INTEG. (B)
        TOTAL     3.780                 -
        ELASTIC   3.780                 -
        CAPTURE   1.9E-4             6.33E-4

  MT=1       SIG-T
         BELOW 3 MEV, THE TOTAL CROSS SECTION WAS CALCULATED
         WITH THE R-MATRIX THEORY.
         ABOVE 3 MEV, BASED ON THE EXPERIMENTAL DATA OF
         CIERJACKS ET AL./1/.
  MT=2       SIG-EL
         BELOW 3 MEV, CALCULATED WITH THE R-MATRIX THEORY.
         ABOVE 3 MEV, THE ELASTIC SCATTERING CROSS SECTION WAS
         OBTAINED BY SUBTRACTING THE REACTION CROSS SECTIONS FROM
         THE TOTAL CROSS SECTION.
  MT=3       NON-ELASTIC
         SUM OF MT=4, 16, 102, 103, 104 AND 107.
  MT=4       TOTAL INELASTIC
         SUM OF MT=51 TO 91.
  MT=16      (N,2N)
         BASED ON EXPERIMENTAL DATA/2/.
  MT=51-79,91  SIG-IN
         SHAPE OF THE EXCITATION FUNCTIONS WAS CALCULATED WITH
         THE STATISTICAL MODEL.
         THE OPTICAL POTENTIAL PARAMETERS ARE THE FOLLOWING:
            V = 48.25-0.053E,  WS = 3.0 + 0.25E,  VSO = 5.5  (MEV)
            R = 1.255       ,  RS = 1.352      ,  RSO = 1.15 (FM)
            A = 0.536       ,  B  = 0.205      ,  ASO = 0.50 (FM).
         LEVEL SCHEME
            NO        ENERGY(MEV)    SPIN-PARITY
          G.S.           0.0             0+
             1           6.0490          0+
             2           6.1300          3-
             3           6.9170          2+
             4           7.1169          1-
             5           8.8720          2-
             6           9.6300          1-
             7           9.8470          2+
             8          10.360           4+
             9          10.960           0-
            10          11.080           3+
            11          11.100           4+
            12          11.520           2+
            13          11.600           3-
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              14           12.050        0+
              15           12.440        1-
              16           12.530        2-
              17           12.800        0-
              18           12.970        2-
              19           13.020        2+
              20           13.090        1-
              21           13.120        3-
              22           13.260        3-
              23           13.660        1+
              24           13.870        4+
              25           13.980        2-
              26           14.030        0+
              27           14.100        3-
              28           14.300        4+
              29           14.400        5+
             CONTINUUM LEVELS WERE ASSUMED ABOVE 14.4 MEV.
             CONSTANT TEMPERATURE OF 3.4 MEV WAS USED.
             FOR THE INELASTIC SCATTERING TO THE SECOND AND THIRD
             LEVELS, THE (N,N')GAMMA DATA OF NORDBORG ET AL./3/ AND
             LUNDBERG ET AL./4/ BELOW 10MEV.
             FOR MT=51 TO 55, THE 14 MEV CROSS SECTIONS WERE
             NORMALIZED TO THE EXPERIMENTAL DATA/5/-/8/.
             CROSS SECTIONS FOR MT=56-64 AND 67 WERE NORMALIZED TO
             REPRODUCE THE DDX DATA AT 14 MEV/8/,/9/.
  MT=102     CAPTURE
           1/V CURVE NORMALIZED TO THE RECOMMENDED VALUE IN THE
           4TH EDITION OF BNL-325 /10/ AT 0.0253 EV.
           ABOVE 100 EV, P-WAVE CAPTURE WAS CONSIDERED./28/
  MT=103     (N,P)
           BASED ON EXPERIMENTAL DATA/11/-/14/.
  MT=104     (N,D)
           BASED ON THE EVALUATION OF FOSTER, JR. AND YOUNG /15/.
  MT=107     (N,ALPHA)
           BASED ON EXPERIMENTAL DATA/3/,/16/-/21/.
  MT=251     MU-BAR
           CALCULATED FROM ANGULAR DISTRIBUTIONS IN MF=4.

MF=4            ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2
           10E-5 EV TO 3 MEV  R-MATRIX CALCULATION
           3 MEV TO 5 MEV     BASED ON THE EXPERIMENTAL DATA OF
                              LISTER AND SAYRES /22/.
           5 MEV TO 9 MEV     MULTI-LEVEL FORMULA/23/.
           9 MEV TO 15 MEV    BASED ON THE EXPERIMENTAL DATA OF
                              GLENDINNING ET AL./24/
           15 MEV TO 20 MEV   CALCULATED WITH THE SPHERICAL
                              OPTICAL MODEL.  THE POTENTIAL
                              PARAMETERS ARE THE SAME AS THOSE
                              GIVEN IN SIG-IN.
  MT=16
           ASSUMED TO BE ISOTROPIC IN THE LABORATORY SYSTEM.
  MT=51-79
           CALCULATED WITH THE STATISTICAL MODEL.
           FOR MT=51, 52 AND 55, EXPERIMENTAL DATA/8/ AT 14.2 MEV.
           FOR MT=53 AND 54 ENDF/B-IV WAS ADOPTED.
  MT=91
           ISOTROPIC DISTRIBUTIONS IN THE CENTER OF MASS SYSTEM
           WERE TRANSFORMED INTO THE ONES IN THE LABORATORY SYSTEM.
           THE FORMULA IS GIVEN IN REF./25/.

MF=5            ENERGY DISTRIBUTION FOR SECONDARY NEUTRONS
  MT=16
           EVAPORATION SPECTRUM WAS ASSUMED.  CONSTANT TEMPERATURE
           WAS DEDUCED FROM THE EXPERIMENTAL DATA OF CHIBA ET AL.
           /26/ FOR LI-7 ACCORDING TO THE SQRT(E/A) LAW.
  MT=91
           EVAPORATION SPECTRUM WAS ASSUMED.  CONSTANT TEMPERATURE
           OF 3.4 MEV WAS DETERMINED FROM THE STAIR CASE PLOTTING.

MF=12           PHOTON PRODUCTION MULTIPLICITIES
  MT=52-68,102,103,107
           CALCULATED WITH GNASH/27/.

MF=13           PHOTON PRODUCTION CROSS SECTIONS
  MT=3
           CALCULATED WITH GNASH/27/.

MF=14           PHOTON ANGULAR DISTRIBUTIONS
  MT=3,52-68,102,103,107
           ISOTROPIC
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MF=15         PHOTON ENERGY DISTRIBUTIONS
  MT=3,102,103,107
         CALCULATED WITH GNASH/27/.
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MAT number =  925
  9-F - 19 JAERI      EVAL-JUL89 T.SUGI
                      DIST-SEP89 REV2-JUN94
HISTORY
83-11 EVALUATION FOR JENDL-2 WAS PERFORMED BY SUGI AND NISHIMURA
      (JAERI)/1/.
89-07 RESONANCE PARAMETERS AND TOTAL CROSS SECTION WERE
      RE-EVALUATED FOR JENDL-3.
89-07 COMPILED BY T. NARITA (JAERI).
94-06 JENDL-3.2.
       GAMMA PRODCTION DATA MODIFIED BY T.ASAMI (DATA ENG.)
       OTHER DATA WERE MAINLY ADOPTED FROM JENDL FUSION FILE.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (3,2), (3,4), (3,22), (3,28), (3,52-91), (3,104), (3,251)
      ALL ANGULAR DISTRIBUTIONS
      ALL ENERGY DISTRIBUTIONS
      NEW EVALUATION FOT GAMMA-RAY PRODUCTION DATA
     ***********************************************************
     -------------------------------------------------------------
      JENDL FUSION FILE /2/  (AS OF JUN. 1994)
            EVALUATED AND COMPILED BY S.CHIBA (NDC/JAERI).

      THE CALCULATIONS HAVE BEEN CARRIED OUT WITH THE SINCROS-II
      CODE SYSTEM (DWUCKY, EGNASH AND CASTHY2Y) /3/.  THE
      FOLLOWING SET OF OMPS WERE SELECTED:
          N     : YAMAMURO (MODIFIED WALTER-GUSS) /3/
          P     : PEREY AND WALTER-GUSS COMBINED /4/
          D     : LOHR-HAEBERLI /5/
          T     : BECCHETTI-GREENLEES /6/
          HE-3  : BECCHETTI-GREENLEES /6/
          ALPHA : LEMOS SET MODIFIED BY ARTHUR-YOUNG /7/

      THE FOLLOWING VALUES OF LEVEL DENSITY PARAMETERS (1/MEV)
      WERE USED TO REPRODUCE THE DDX AT 14 MEV:

      F-20 F-19 F-18 O-19 O-18 O-17 N-17 N-16 N-15 N-14 C-15 C-14
      4.49 3.50 2.50 2.50 3.00 2.99 3.51 2.00 2.00 2.03 2.84 2.46

      THE DATA WERE TAKEN FROM JENDL-3.1 EXCEPT FOR THE FOLLOWING:

       MF=3, MT= 2: ADJUSTED TO CONSERVE THE TOTAL C.S.
       MF=3, MT= 3: CALCULATED AS A SUM OF REACTION C.S.
       MF=3, MT= 4: CALCAULATED AS A SUM OF INELASTIC C.S.
       MF=3, MT=22, 28, 32, 91 : TAKEN FROM THE SINCROS-II
                    CALCULATION
       MF=3, MT=52: REPLACED BY THE SINCROS-II CALCULATION ABOVE
                    2.5 MEV
       MF=3, MT=53-60: REPLACED BY THE SINCROS-II CALCULATION
       MF=3, MT=203,204,205,207: TAKEN FROM THE SINCROS-II CALC.
       MF=4, MT= 2: REPALCED BY THE SINCROS-II CALCULATION
       MF=6, MT=22, 28, 32, 91 : TAKEN FROM THE SINCROS-II
                    CALCULATION.  KUMABE'S SYSTEMATICS WAS USED.
       MF=6, MT=203,204,205,207: TAKEN FROM THE SINCROS-II
                    CALCULATION.  KALBACH'S SYSTEMATICS WAS USED.
     -------------------------------------------------------------


MF=1  GENERAL INFORMATION
  MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
  MT=151  RESOLVED RESONANCE PARAMETERS : 1.0E-5 EV - 100 KEV
      THE MULTI-LEVEL BREIT-WIGNER FORMULA WAS USED.
      RES. ENERGIES AND GAM-N : THE FIRST TWO LEVELS WERE BASED ON
         JOHNSON ET AL. /8/.  THE 3RD AND 4TH LEVELS WERE ADJUSTED
         SO AS TO FIT TO THE EXPERIMENTAL DATA OF LARSON ET AL./9/
      GAM-G : THE FIRST THREE LEVELS WERE BASED ON MACKLIN AND
         WINTERS /10/.  THE 4TH LEVEL WAS ADJUSTED SO AS TO FIT TO
         THE RECOMMENDED THERMAL CAPTURE CROSS SECTION OF
         MUGHABGHAB ET AL./11/.
      SCATTERING RADIUS: 5.525 FM

      CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS.
                     2200 M/S      RES. INTEG.
         ELASTIC     3.643 B          -
         CAPTURE     9.6 MILLI-B   19.5 MILLI-B
         TOTAL       3.652 B          -

MF=3  NEUTRON CROSS SECTIONS
  MT=1    TOTAL CROSS SECTION
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    BELOW 100 KEV: NO BACKGROUND.
    ABOVE 100 KEV: BASED ON THE EXPERIMENTAL DATA OF LARSON ET
    AL./9/
MT=2    ELASTIC SCATTERING CROSS SECTION
    DERIVED BY SUBTRACTING THE NONELASTIC CROSS SECTION FROM
    THE TOTAL CROSS SECTION.
MT=4    TOTAL INELASTIC SCATTERING CROSS SECTION
    SUM OF MT=51-60,91.
MT=16   (N,2N) CROSS SECTION
    CALCULATED BY FITTING THE PEARLSTEIN'S FUNCTION /12/ TO THE
    EXPERIMENTAL DATA.
MT=22   (N,N' ALPHA) AND (N,ALPHA N') CROSS SECTIONS
    CALCULATED BY THE SINCROS-II CODE SYSTEM.
MT=28   (N,N' P) AND (N,P N') CROSS SECTIONS
    CALCULATED BY THE SINCROS-II CODE SYSTEM.
MT=51-60  INELASTIC SCATTERING CROSS SECTIONS
    MT=51 (TAKEN FROM JENDL-3.1)
      UP TO 1 MEV     : BASED ON THE EXPERIMENTAL DATA OF BRODER
             ET AL. /13/.
      1 MEV - 5.5 MEV : CALCULATED WITH THE HAUSER-FESHBACH
             METHOD (ELIESE-3 /14/) TAKING INTO ACCOUNT
             (N,ALPHA) AND (N,P) AS COMPETING PROCESSES.  THE
             LEVEL SCHEME OF F-19, N-16 AND O-19 WAS TAKEN FROM
             AJZENBERG-SELOVE /15,16/.  THE OPTICAL POTENTIAL
             PARAMETERS ARE :
                  V  = 51.56 - 1.492*E     (MEV),
                  WS = 11.82               (MEV),
                  VSO= 10.0                (MEV),
                  R0 = RS = RSO = 1.31     (FM),
                  A = ASO = 0.66           (FM),
                  B = 0.47                 (FM).
       THE LEVEL DENSITY PARAMETER OF 3.609 (1/MEV)/17/ AND
       PAIRING ENERGY OF 2.52 MEV /18/ WERE USED.
    MT=52
      UP TO 2.5 MEV: TAKEN FROM JENDL-3.1, WHICH IS BASED ON THE
                     DATA OF BRODER ET AL. /13/.
      ABOVE 2.5 MEV: CALCULATED BY THE SINCROS-II CODE SYSTEM.
    MT=53 - 60
      CALCULATED BY THE SINCROS-II CODE SYSTEM.
    THE SINCROS-II CALCULATION ADOPTED THE FOLLOWING DISCRETE
    LEVELS.  THE LEVELS WITH L AND BETA-L INCLUDE THE
    CONTRIBUTION OF DIRECT INELASTIC SCATTERING, WHICH WAS
    CALCULATED ASSUMING THE WEAK-COUPLING MODEL BY THE DWBA
    METHOD:
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MT	EX(MEV)	SPIN-PARITY	L	BETA-L
2	0.0	1/2+		
51	0.1099	1/2-		
52	0.1972	5/2+	2	0.4
53	1.3457	5/2-		
54	1.4585	3/2-		
55	1.5541	3/2+	2	0.6
56	2.7798	9/2+	4	0.4
57	3.9071	3/2+		
58	3.9985	7/2-		
59	4.0325	9/2-		
60	4.3777	7/2+	4	0.4

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MT=91   INELASTIC TO CONTINUUM
    CALCULATED WITH SINCROS-II CODE SYSTEM.
MT=102  CAPTURE CROSS SECTION
    BELOW 100 KEV      : NO BACKGROUND.
    100 KEV - 1.87 MEV : BASED ON THE EXPERIMENTAL DATA OF
                         GABBARD ET AL. /19/.
    1.87 MEV - 20 MEV  : ASSUMED TO DECREASE WITH 1/V LAW.
MT=103  (N,P) CROSS SECTION
    UP TO 9 MEV     : BASED ON THE EXPERIMENTAL DATA OF BASS ET
                      AL. /20/.
    9 MEV - 20 MEV  : CALCULATED WITH THE STATISTICAL MODEL BY
                      USING PEARLSTEIN' EMPIRICAL FORMULA.
MT=104  (N,D) CROSS SECTION
    CALCULATED BY THE SINCROS-II CODE SYSTEM.
MT=105  (N,T) CROSS SECTION
    CALCULATED BY THE SINCROS-II CODE SYSTEM.
MT=107  (N,ALPHA) CROSS SECTION
    BELOW 9 MEV, BASED ON THE FOLLOWING EXPERIMENTAL DATA:
        UP TO 4MEV       DAVIS ET AL. /21/,
        4MEV - 5.5MEV    SMITH ET AL. /22/,
        5.5MEV - 9MEV    BASS ET AL. /20/.
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    ABOVE 9 MEV, CALCULATED WITH THE PEARLSTEIN'S FORMULA.
  MT=251  AVERAGE COSINE IN THE LABORATORY SYSTEM
    DERIVED FROM THE ANGULAR DISTRIBUTIONS.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2
    CALCULATED WITH OPTICAL MODEL BY THE SINCROS-II CODE SYSTEM.
  MT=16,22,28
    CALCULATED BASED ON KUMABE'S SYSTEMATICS /23/.
  MT=51-60
    CALCULATED BY THE SINCROS-II CODE SYSTEM.
  MT=91
    CALCULATED BASED ON KUMABE'S SYSTEMATICS /23/.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,22,28.91
    CALCULATED BY THE SINCROS-II CODE SYSTEM.
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MAT number = 1125

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 11-NA- 23 SRI        EVAL-MAR87 H.YAMAKOSHI(SHIP RESEARCH INST.)
                      DIST-SEP89 REV2-NOV93
HISTORY
 87-03  NEW EVALUATION WAS MADE FOR JENDL-3.
 89-08  THE DATA FOR MF=15,MT=102 MODIFIED.
 93-11  JENDL-3.2
        MF=3,MT=1: MODEFIED BY T.FUKAHORI(JAERI)
        MF=4,MT=91: CHANGED TO LAB. SYSTEM BY T.NAKAGAWA(JAERI)
        GAMMA-RAY PART: MODEFIED BY T.ASAMI(DATA ENG. CO. LTD.)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      ( 3,  1)      LARSON'S DATA/1/ ABOVE 1 MEV
      ( 3,  2)      ACCORDING TO (3,1) ABOVE 1 MEV
      (3,16),(3,22),(3,51),(3,103),(3,107)  AROUND THRESHOLD
                    ENERGIES.
      ( 4, 91)      CHANGED TO LAB. SYSTEM
      (12,51-61)    UPPER ENERGY LIMIT: 6.26 MEV
      (12,62-67)    ADDED
      (12,102)      FROM ENERGY BALANCE
                    UPPER ENERGY LIMIT: 6.26 MEV
      (12,103)      UPPER ENERGY LIMIT: 6.26 MEV
      (13,  3)      LOWER ENERGY LIMIT: 6.26 MEV
      (14,62-67)    ADDED
      (15,102)      RECALCULATION BY CASTHY AT 1.0E-5,0.0253 EV.
     ***********************************************************


MF=1  GENERAL INFORMATION
 MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
 MT=151  RESOLVED RESONANCE PARAMETERS
   RESOLVED PARAMETERS FOR MLBW FORMULA WERE GIVEN IN THE ENERGY
   REGION FROM 1.0E-5 EV TO 350 KEV.  PARAMETERS WERE MAINLY TAKEN
   FROM THE RECOMMENDED DATA OF BNL /2/, AND THE DATA FOR SOME
   LEVELS WERE MODIFIED SO THAT THE CALCULATED TOTAL CROSS SEC-
   TIONS FOR NA-23 WERE FITTED TO THE EXPERIMENTAL DATA.  THE
   SCATTERING RADIUS WAS ASSUMED TO BE 5.2 FERMI.  CALCULATED 2200
   M/SEC CROSS SECTIONS AND RESONANCE INTEGRALS ARE AS FOLLOWS:

           2200 M/S CROSS SECTION(B)     RES. INTEGRAL(B)
   ELASTIC       3.024
   CAPTURE       0.531                          0.3122
   TOTAL         3.555

MF=3  NEUTRON CROSS SECTIONS
  BELOW 350 KEV, BACKGROUND CROSS SECTION WAS GIVEN FOR THE TOTAL
  AND ELASTIC SCATTERING CROSS SECTIONS.  THE CROSS-SECTION DATA
  ARE REPRODUCED FROM THE EVALUATED RESOLVED RESONANCE PARAMETERS
  WITH MLBW FORMULA.  ABOVE 350 KEV, THE TOTAL AND PARTIAL CROSS
  SECTIONS WERE GIVEN POINTWISE.
 MT=1 TOTAL
  IN THE ENERGIES BETWEEN 350 KEV AND 14 MEV, EVALUATED BASED ON
  THE EXPERIMENTAL DATA OF CIERJACKS/3/ IN TRACING THEIR FINE
  STRUCTURES. ABOVE 14 MEV, BASED ON THE EXPERIMENTAL DATA OF
  LANGSFORD/4/, STOLER/5/ AND LARSON/1/.  MODEFICATION WAS DONE BY
  T.FUKAHORI(JAERI) TO BE BASED ON THE EXPERIMENTAL DATA OF ONLY
  LARSON/1/ ABOVE 1 MEV.
 MT=2 ELASTIC SCATTERING
  OBTAINED BY SUBTRACTING THE SUM OF THE PARTIAL CROSS SECTIONS
  FROM THE TOTAL CROSS SECTION.
 MT=4, 51-77, 91 INELASTIC SCATTERING
  BELOW 5 MEV, THE INELASTIC SCATTERING CROSS SECTION TO THE 1ST
  LEVEL(MT=51) WAS EVALUATED BASED ON THE EXPERIMENTAL DATA OF
  TOWLE AND GILBOY/6/, CHRIEN AND SMITH/7/, AND LIND AND DAT/8/.
  BELOW 5 MEV, THE INELASTIC SCATTERING CROSS SECTION TO THE 2ND
  AND 3RD LEVEL(MT=52, 53) WAS EVALUATED BASED ON THE EXPERIMENTAL
  DATA OF FREEMAN AND MONTAGUE/9/, LIND AND DAT/8/, AND TOWLE AND
  OWENS/10/. FOR THE INELASTIC SCATTERING CROSS SECTIONS TO THE
  1ST TO 3RD LEVELS ABOVE 5 MEV AND THE OTHER INELASTIC SCATTERING
  DATA, OPTICAL AND STATISTICAL MODEL CALCULATIONS WERE MADE WITH
  THE CASTHY CODE/11/, TAKING ACCOUNT OF THE CONTRIBUTION FROM THE
  COMPETING PROCESSES. THE DIRECT COMPONENT WAS CALCULATED WITH
  WITH THE DWUCK CODE/12/ FOR FIVE LOWEST LEVELS. THE DEFORMATION
  PARAMETERS WERE ESTIMATED BASED ON A WEAK COUPLING MODEL.  THE
  OPTICAL POTENTIAL PARAMETERS USED ARE:
    V = 46.0 - 0.25*EN,       VSO = 6.0        (MEV)
   WS = 14.0 - 0.2*EN,         WV = 0.125*EN (MEV)
    R = 1.286, RS = 1.39,  RSO = 1.07          (FM)
    A = 0.62,  ASO = 0.62,   B = 0.7           (FM)
 THE LEVEL DATA USED IN THE ABOVE TWO CALCULATIONS WERE TAKEN
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FROM REF./13/ AS FOLLOWS:

MT	LEVEL ENERGY(MEV)	SPIN-PARITY
	0.0	3/2+
51	0.4399	5/2+
52	2.0764	7/2+
53	2.3909	1/2+
54	2.6398	1/2-
55	2.7037	9/2+
56	2.9824	3/2+
57	3.6783	3/2-
58	3.8480	5/2-
59	3.9147	5/2+
60	4.4320	1/2+
61	4.7756	7/2+
62	5.3800	3/2+
63	5.5360	11/2+
64	5.7410	3/2+
65	5.7660	5/2+
66	5.9310	1/2-
67	5.9670	3/2-
68	6.0430	1/2-
69	6.1170	11/2+
70	6.1910	11/2+
71	6.2360	13/2+
72	6.3080	1/2+
73	6.3506	9/2-
74	6.5770	5/2+
75	6.6170	9/2+
76	6.7340	3/2+
77	6.8680	5/2+

LEVELS ABOVE 6.9 MEV WERE ASSUMED TO BE OVERLAPPING.

MT=16 (N,2N)
MAINLY BASED ON THE EXPERIMENTAL DATA OF ADAMSKI/14/.
MT=22 (N,NA)
CALCULATED WITH THE GNASH CODE/15/ AND NORMALIZED TO THE EXPERIMENTAL DATA OF WOELFER/16/ AT 16.4 MEV.
MT=28 (N,NP)
CALCULATED WITH THE GNASH CODE/15/.
MT=102 CAPTURE
CALCULATED WITH THE CASTHY CODE/11/ AND NORMALIZED TO 0.3 MB AT 500 KEV.
MT=103 (N,P)
BELOW 10 MEV, BASED ON THE EXPERIMENTAL DATA/17,18/.
ABOVE 10 MEV, CALCULATED WITH THE GNASH CODE/15/ AND NORMALIZED TO CONNECT SMOOTHLY WITH THE DATA BELOW 10 MEV.
MT=107 (N,A)
BELOW 12 MEV, BASED ON THE EXPERIMENTAL DATA/17,18/.
ABOVE 12 MEV, CALCULATED WITH THE GNASH CODE/15/ AND NORMALIZED TO CONNECT SMOOTHLY WITH THE DATA BELOW 10 MEV.
MT=251 MU-BAR
CALCULATED WITH THE OPTICAL MODEL.

MF=4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=2
CALCULATED WITH THE CASTHY CODE/11/.
MT=51-77
CALCULATED WITH THE CASTHY CODE/11/ AND THE DWUCK CODE/7/.
MT=91
CALCULATED WITH THE CASTHY CODE/11/ AND TRANSFORMED INTO THE LABORATORY SYSTEM.
MT=16, 22, 28
ASSUMED TO BE ISOTROPIC IN THE LABORATORY SYSTEM.

MF=5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=16, 22, 28, 91
CALCULATED WITH THE GNASH CODE/15/.

MF=12 PHOTON PRODUCTION MULTIPLICITIES
MT=51-67,102,103
CALCULATED WITH THE GNASH CODE.
FOR THE JENDL-3.2, MODIFICATIONS WERE DONE FOR ENERGY BALANCE AND FOR CHANGING UPPER ENERGY LIMIT FROM 5.21937 MEV TO 6.26325 MEV.

MF=13 PHOTON PRODUCTION CROSS SECTIONS
MT=3
CALCULATED WITH THE GNASH CODE/15/.
FOR THE JENDL-3.2, LOWER ENERGY LIMIT WAS CHANGED TO 6.26325 MEV, ACCORDING TO MF=12 MODIFICATION.

MF=14 PHOTON ANGULAR DISTRIBUTIONS

MT=3,51-67,102,103
ASSUMED TO BE ISOTROPIC IN THE LABORATORY SYSTEM.

MF=15 CONTINUOUS PHOTON ENERGY SPECTRA
MT=3,103
CALCULATED WITH THE GNASH CODE/15/.
MT=102
CALCULATED WITH THE GNASH CODE/15/ AND MODIFIED AT THERMAL BASED ON THE EXPERIMENTAL DATA OF MAERKER/19/ AND CASTHY CALCULATION.

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13) ENSDF(EVALUATED NUCLEAR STRUCTURE DATA FILE)
14) ADAMSKI L. ET AL. : ANNA. NUCL. ENER. 7, 397 (1980).
15) YOUNG P.G. AND ARTHUR E.D. : LA-6947 (1977).
16) WOELFER G. ET AL. : Z. PHYS. 194, 75 (1966).
17) WILLIAMSON C.F. : PHYS. REV. 122, 1877 (1961).
18) BASS R. ET AL. : 1965 ANTWERP CONF. 495 (1966).
19) MAERKER R.E. : ORNL-TM-5203 (1976).

MAT number = 1200

```
 12-MG-  0 DEC,NEDAC  EVAL-MAR87 M.HATCHYA(DEC),T.ASAMI(NEDAC)
                      DIST-SEP89 REV2-NOV93
HISTORY
87-03 NEW EVALUATION WAS MADE FOR JENDL-3.
87-03 COMPILED BY T.ASAMI.
93-11 JENDL-3.2.
        GAMMA-PRODUCTION DATA MODIFIED BY T.ASAMI(DATA ENG.)
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (12,102)    BELOW 3 MEV
      (13,4)      BELOW 3 MEV
      (14,4)      NEW
      (15,102)    MODIFIED AT 1.0E-5 AND 0.0253 EV
     ***********************************************************


MF=1  GENERAL INFORMATION
 MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
 MT=151  RESOLVED RESONANCE PARAMETERS
   RESOLVED PARAMETERS FOR MLBW FORMULA WERE GIVEN IN THE ENERGY
   REGION FROM 1.0E-5 EV TO 520 KEV.  THE DATA ARE CONSTRUCTED
   FROM THE EVALUATED RESONANCE PARAMETERS FOR MG-24, -25 AND -26,
   CONSIDERING THEIR ABUNDANCES IN THE MG ELEMENT/1/.

            2200 M/S CROSS SECTION(B)     RES. INTEGRAL(B)
    ELASTIC      3.53
    CAPTURE      0.063                        0.0366
    TOTAL        3.59

MF=3  NEUTRON CROSS SECTIONS
   BELOW 520 KEV, ZERO BACKGROUND CROSS SECTION WAS GIVEN.
   ABOVE 520 KEV, THE TOTAL AND PARTIAL CROSS SECTIONS WERE GIVEN
   POINTWISE.
   ALL THE CROSS-SECTION DATA WERE CONSTRUCTED FROM THE EVALUATED
   ONES FOR THREE STABLE ISOTOPES OF MG CONSIDERING THEIR
   ABUNDANCES IN THE MG ELEMENT,
 MT=1 TOTAL
   CONSTRUCTED FROM THE EVALUATED DATA FOR STABLE ISOTOPES OF MG.
 MT=2 ELASTIC SCATTERING
   OBTAINED BY SUBTRACTING THE SUM OF THE PARTIAL CROSS SECTIONS
   FROM THE TOTAL CROSS SECTION.
 MT=4, 51-90, 91 INELASTIC SCATTERING
   CONSTRUCTED FROM THE EVALUATED DATA FOR STABLE ISOTOPES OF MG
   AS FOLLOWS:
    MT   LEVEL ENERGY(MEV) MG-24   MG-25  MG-26
             0.0
    51       0.5851                 51
    52       0.9748                 52
    53       1.3686          51
    54       1.6118                 53
    55       1.8087                        51
    56       1.9647                 54
    57       2.5638                 55
    58       2.7377                 56
    59       2.8011                 57
    60       2.9384                        52
    61       3.4052                 58
    62       3.4137                 59
    63       3.5880                        53
    64       3.9078                 60
    65       3.9405                        54
    66       3.9707                 61
    67       4.0596                 62
    68       4.1200         52
    69       4.2384         53
    70       4.2770                 63
    71       4.3180                        55
    72       4.3320                        56
    73       4.3500                        57
    74       4.3594                 64
    75       4.7114                 65
    76       4.7220                 66-67
    77       4.8340                        58
    78       4.9000                        59
    79       4.9700                        60
    80       5.2361         54
    81       5.2910                        61
    82       5.4740                        62
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83	5.6900		63
84	6.0103	55	
85	6.4322	56	
86	7.3479	57	
87	7.5530	58	
88	7.6162	59	
89	7.7472	60	
90	7.8120	61	

LEVELS ABOVE 7.98 MEV WERE ASSUMED TO BE OVERLAPPING.

MT=16, 22, 28, 102, 103 AND 107 (N,2N), (N,NA), (N,NP), (N,GAMMA), (N,P) AND (N,A)
CONSTRUCTED FROM THE EVALUATED DATA FOR THREE STABLE ISOTOPES OF MG, TAKING ACCOUNT OF THEIR ABUNDANCES IN THE MG ELEMENT. THE CALCULATED CAPTURE CROSS SECTIONS WERE NORMALIZED SO AS TO REPRODUCE THE ELEMENT MG DATA OF 72 MB AT 500 KEV/2/.

MT=251 MU-BAR
CONSTRUCTED FROM THE EVALUATED DATA FOR STABLE ISOTOPES OF MG, TAKING ACCOUNT OF THEIR ABUNDANCES IN THE MG ELEMENT.

MF=4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS

MT=2
CONSTRUCTED FROM THE EVALUATED DATA FOR STABLE ISOTOPES OF MG, TAKING ACCOUNT OF THEIR ABUNDANCES IN THE MG ELEMENT.

MT=51-90, 91
CONSTRUCTED WITH THE EVALUATED DATA FOR STABLE ISOTOPES OF MG, TAKING ACCOUNT OF THEIR ABUNDANCES IN THE MG ELEMENT.

MT=16, 22, 28
ISOTROPIC IN THE LABORATORY SYSTEM.

MF=5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS

MT=16, 22, 28, 91
CONSTRUCTED FROM THE EVALUATED DATA FOR STABLE ISOTOPES OF MG, TAKING ACCOUNT OF THEIR ABUNDANCES IN THE MG ELEMENT.

MF=12 PHOTON PRODUCTION MULTIPLICITIES

MT=102
FROM ENERGY BALANCE.

MF=13 PHOTON PRODUCTION CROSS SECTIONS

MT=3 (ABOVE 3 MEV)
CALCULATED WITH THE GNASH CODE/3/.

MT=4 (BELOW 3 MEV)
CALCULATED FROM INELASTIC CROSS SECTIONS AND TRANSITION PROBABITIES OF MG ISOTOPES.

MF=14 PHOTON ANGULAR DISTRIBUTIONS

MT=3, 4, 102
ASSUMED TO BE ISOTROPIC IN THE LABORATORY SYSTEM.

MF=15 CONTINUOUS PHOTON ENERGY SPECTRA

MT=3
CALCULATED WITH THE GNASH CODE/3/.

MT=102
CALCULATED WITH THE CASTHY CODE/4/ BELOW 0.0253 EV AND WITH THE GNASH CODE/3/ AT HIGHER ENERGIES.

REFERENCES

1) HOLDEN N.E., MARTIN R.L. AND BARNES I.L. : PURE & APPL. CHEM. 56, 675 (1984).
2) GRENIER ET AL. : CEA-N-2195 (1981).
3) YOUNG P.G. AND ARTHUR E.D. : LA-6947 (1977).
4) IGARASI S. AND FUKAHORI T.: JAERI 1321 (1991).

MAT number = 1225

```
 12-MG- 24 DEC,NEDAC  EVAL-MAR87 M.HATCHYA(DEC), T.ASAMI(NEDAC)
                      DIST-SEP89 REV2-APR93
HISTORY
 87-03  NEW EVALUATION WAS MADE FOR JENDL-3.
 87-03  COMPILED BY T.ASAMI.
 93-04  JENDL-3.2
        COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (4,91)              CHANGED TO THE LABORATORY SYSTEM
     ***********************************************************

MF=1  GENERAL INFORMATION
 MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
 MT=151  RESOLVED RESONANCE PARAMETERS
   RESOLVED PARAMETERS FOR MLBW FORMULA WERE GIVEN IN THE ENERGY
   REGION FROM 1.0E-5 EV TO 520 KEV.  PARAMETERS WERE TAKEN FROM
   THE RECOMMENDED DATA OF BNL/1/ AND THE DATA FOR A NEGATIVE
   RESONANCE WERE ADDED SO AS TO REPRODUCE THE RECOMMENDED THERMAL
   CROSS SECTIONS FOR CAPTURE AND SCATTERING/1/.  THE DATA FOR
   SOME LEVELS WERE MODIFIED SO THAT THE CALCULATED TOTAL CROSS
   SECTIONS OF THE ELEMENT MG WERE FITTED TO THE EXPERIMENTAL DATA
   OF HIBDON/2/ AND SINGH/3/.  THE SCATTERING RADIUS WAS ASSUMED
   TO BE 5.4 FERMI.  CALCULATED 2200 M/SEC CROSS SECTIONS AND
   RESONANCE INTEGRALS ARE AS FOLLOWS:

           2200 M/S CROSS SECTION(B)     RES. INTEGRAL(B)
   ELASTIC      3.75
   CAPTURE      0.050                       0.0312
   TOTAL        3.80

MF=3  NEUTRON CROSS SECTIONS
  BELOW 520 KEV, NO BACKGROUND CROSS SECTION IS GIVEN AND ALL THE
  CROSS-SECTION DATA ARE REPRODUCED FROM THE EVALUATED RESOLVED
  RESONANCE PARAMETERS WITH THE MLBW FORMULA.
  ABOVE 520 KEV, THE TOTAL AND PARTIAL CROSS SECTIONS ARE GIVEN IN
  THE POINTWISE FORM.
 MT=1 TOTAL
  OPTICAL AND STATISTICAL MODEL CALCULATION WAS MADE WITH
  CASTHY CODE/4/. THE OPTICAL POTENTIAL PARAMETERS USED ARE:
       V = 49.68,              VSO = 7.12    (MEV)
      WS = 7.76 - 0.5*EN,       WV = 0       (MEV)
       R = 1.17,  RS = 1.09,  RSO = 1.17     (FM)
       A = 0.6,   ASO = 0.6,    B = 0.69     (FM)
 MT=2 ELASTIC SCATTERING
  OBTAINED BY SUBTRACTING THE SUM OF THE PARTIAL CROSS SECTIONS
  FROM THE TOTAL CROSS SECTION.
 MT=4, 51-61, 91 INELASTIC SCATTERING
  CALCULATED WITH CASTHY /4/, TAKING ACCOUNT OF THE CONTRIBUTION
  FROM THE COMPETING PROCESSES. THE DIRECT COMPONENTS FOR MT=51
  AND 52 WERE, CALCULATED WITH THE DWUCK/5/. THE CALCULATED DATA
  FOR THE FIRST LEVEL WERE NORMALIZED AT 12 MEV TO THE EXPERIMEN-
  TAL DATA/6/.  THE LEVEL DATA USED IN THESE TWO CALCULATIONS WERE
  TAKEN FROM REF./7/ AS FOLLOWS:
       MT   LEVEL ENERGY(MEV)   SPIN-PARITY
            0.0                 0+
       51       1.3686              2+
       52       4.1200              4+
       53       4.2384              2+
       54       5.2361              3+
       55       6.0103              4+
       56       6.4322              0+
       57       7.3479              2+
       58       7.5530              1-
       59       7.6162              3-
       60       7.7472              1+
       61       7.8120              3+
  LEVELS ABOVE 10.0 MEV WERE ASSUMED TO BE OVERLAPPING.


 MT=16, 22, 28, 103, 107      (N,2N), (N,NA), (N,NP), (N,P), (N,A)
   CALCULATED WITH THE GNASH CODE/8/ USING THE ABOVE OPTICAL MODEL
   PARAMETERS.  THE (N,2N) CROSS SECTIONS WERE MODIFIED SO AS TO
   FIT TO THE EXPERIMENTAL DATA.
 MT=102      CAPTURE
   CALCULATED WITH THE CASTHY CODE/4/ AND NORMALIZED TO 1.8 MB
   AT 30 KEV.
 MT=251      MU-BAR
   CALCULATED WITH THE OPTICAL MODEL.
```

```
MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=2
   CALCULATED WITH THE CASTHY CODE/4/.
 MT=51-61
   CALCULATED WITH THE CASTHY CODE/4/, AND CONTRIBUTIONS FROM THE
   DIRECT PROCESS CALCULATED WITH THE DWUCK CODE/5/ WERE ADDED TO
   MT=51 AND 52.
 MT=91
   CALCULATED WITH THE CASTHY CODE/4/ AND TRANSFORMED INTO THE
   LABORATORY SYSTEM.
 MT=16, 22, 28
   ASSUMED TO BE ISOTOROPIC IN THE LABORATORY SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=16, 22, 28, 91
   CALCULATED WITH THE GNASH CODE/8/.
```

REFERENCES


```
1) MUGHABGHAB S.F. AND GARBER D.I. :"NEUTRON CROSS SECTIONS", VOL.
   1, PART B (1984).
2) HIBDON C.T. : TAKEN FROM EXFOR (1969).
3) SINGH U.N. ET AL. : PHYS. REV. C10, 2150 (1974).
4) IGARASI S. : J. NUCL. SCI. TECH. 12, 67 (1975).
5) KUNZ P.D. : UNPUBLISHED.
6) FOERTSCH ET AL. : NUCL. INSTR. METH. 169, 533 (1980).
7) ENSDF(EVALUATED NUCLEAR STRUCTURE DATA FILE)
8) YOUNG P.G. AND ARTHUR E.D. : LA-6947 (1977).
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```
MAT number = 1228
 12-MG- 25 DEC,NEDAC  EVAL-MAR87 M.HATCHYA(DEC),T.ASAMI(NEDAC)
                      DIST-SEP89

HISTORY
 87-03  NEW EVALUATION WAS MADE FOR JENDL-3.
 87-03  COMPILED BY T.ASAMI.

MF=1  GENERAL INFORMATION
 MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
 MT=151  RESOLVED RESONANCE PARAMETERS
   RESOLVED PARAMETERS FOR MLBW FORMULA WERE GIVEN IN
   THE ENERGY REGION FROM 1.0E-5 EV TO 220 KEV.
   PARAMETERS WERE TAKEN FROM THE RECOMMENDED DATA OF BNL/1/ AND
   MODIFIED FOR SOME LEVELS SO AS TO REPRODUCE THE EXPERI-
   MENTAL TOTAL CROSS SECTION OF THE ELEMENT MG.
   THE DATA FOR A NEGATIVE RESONANCE WERE ADDED SO AS TO REPRODUCE
   THE RECOMMENDED THERMAL CROSS SECTIONS FOR CAPTURE AND SCATTER-
   ING/1/.
   THE DATA FOR SOME LEVELS WERE MODIFIED SO THAT THE CALCULATED
   TOTAL CROSS SECTIONS OF THE ELEMENT MG WERE FITTED TO THE
   EXPERIMENTAL DATA OF HIBDON/2/ AND SINGH/3/.
   THE SCATTERING RADIUS WAS ASSUMED TO BE 4.9 FERMI.
   CALCULATED 2200 M/SEC CROSS SECTIONS AND RESONANCE INTEGRALS
   ARE AS FOLLOWS:
           2200 M/S CROSS SECTION(B)     RES. INTEGRAL(B)
   ELASTIC     2.60
   CAPTURE     0.190                       0.0989
   TOTAL       2.79

MF=3  NEUTRON CROSS SECTIONS
  BELOW 220 KEV, ZERO BACKGROUND CROSS SECTION WAS GIVEN AND  ALL
  THE CROSS-SECTION DATA ARE REPRODUCED FROM THE EVALUATED RESOLV-
  ED RESONANCE PARAMETERS WITH MLBW FORMULA.
  ABOVE 220 KEV, THE TOTAL AND PARTIAL CROSS SECTIONS WERE GIVEN
  POINTWISE.
 MT=1 TOTAL
  OPTICAL AND STATISTICAL MODEL CALCULATION WAS MADE WITH
  THE CASTHY CODE/2/. THE OPTICAL POTENTIAL PARAMETERS USED ARE:
    V = 49.68,              VSO = 7.12   (MEV)
   WS = 7.76 - 0.5*EN,        WV = 0      (MEV)
    R = 1.17,  RS = 1.09,  RSO = 1.17      (FM)
    A = 0.6,   ASO = 0.6,    B = 0.69      (FM)
 MT=2 ELASTIC SCATTERING
  OBTAINED BY SUBTRACTING THE SUM OF THE PARTIAL CROSS SECTIONS
  FROM THE TOTAL CROSS SECTION.
 MT=4, 51-67, 91 INELASTIC SCATTERING
  CALCULATED WITH CASTHY/2/, TAKING ACCOUNT OF THE CONTRIBUTION
  FROM THE COMPETING PROCESSES. THE DIRECT COMPONENT WAS
  CALCULATED WITH THE DWUCK/3/.
  THE LEVEL DATA USED IN THE ABOVE TWO CALCULATIONS WERE TAKEN
  FROM REF./4/ AS FOLLOWS:
    MT   LEVEL ENERGY(MEV)   SPIN-PARITY
           0.0                  5/2+
    51     0.5851               1/2+
    52     0.9748               3/2+
    53     1.6118               7/2+
    54     1.9647               5/2+
    55     2.5638               1/2+
    56     2.7377               7/2+
    57     2.8011               3/2+
    58     3.4052               9/2+
    59     3.4137               3/2-
    60     3.9078               5/2+
    61     3.9707               7/2-
    62     4.0596               9/2+
    63     4.2770               1/2-
    64     4.3594               3/2+
    65     4.7114               9/2+
    66     4.7220               1/2-
    67     5.0122               7/2+
  LEVELS ABOVE 8.0 MEV WERE ASSUMED TO BE OVERLAPPING.

 MT=16, 22, 28, 103, 107     (N,2N), (N,NA), (N,NP), (N,P), (N,A)
   CALCULATED WITH THE GNASH CODE/5/ USING THE ABOVE OPTICAL
   MODEL PARAMETERS
   THE (N,P) CROSS SECTIONS WERE NORMALIZED TO THE EXPERIMENTAL
   DATA AT 14 MEV OF BORMANN/6/.
 MT=102      CAPTURE
   CALCULATED WITH THE CASTHY CODE/2/ AND NORMALIZED TO 4.7 MB
```

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   AT 30 KEV.
 MT=251       MU-BAR
   CALCULATED WITH THE OPTICAL MODEL.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=2
   CALCULATED WITH THE CASTHY CODE/2/.
 MT=51-67
   CALCULATED WITH THE CASTHY CODE/2/ AND THE DWUCK CODE/3/.
 MT=91
   CALCULATED WITH THE CASTHY CODE/2/.
 MT=16, 22, 28
   ISOTROPIC IN THE LABORATORY SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=16, 22, 28, 91
   CALCULATED WITH THE GNASH CODE/5/.
```

REFERENCES

1) MUGHABGHAB S.F. AND GARBER D.I. :"NEUTRON CROSS SECTIONS", VOL. 1, PART B (1984).
2) HIBDON C.T. : TAKEN FROM EXFOR (1969).
3) SINGH U.N. ET AL. : PHYS. REV. C10, 2150 (1974).
4) IGARASI S. : J. NUCL. SCI. TECH. 12, 67 (1975).
5) KUNZ P.D. : UNPUBLISHED.
6) ENSDF(EVALUATED NUCLEAR STRUCTURE DATA FILE)
7) YOUNG P.G. AND ARTHUR E.D. : LA-6947 (1977).
8) BORMANN M. ET AL. : 1966 PARIS CONF. VOL.1, 225 (1967).

MAT number = 1231

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 12-MG- 26 DEC,NEDAC  EVAL-MAR87 M.HATCHYA(DEC),T.ASAMI(NEDAC)
                      DIST-SEP89

HISTORY
 87-03  NEW EVALUATION WAS MADE FOR JENDL-3.
 87-03  COMPILED BY T.ASAMI.

MF=1  GENERAL INFORMATION
 MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
 MT=151  RESOLVED RESONANCE PARAMETERS
   RESOLVED PARAMETERS FOR MLBW FORMULA WERE GIVEN IN
   THE ENERGY REGION FROM 1.0E-5 EV TO 450 KEV.
   PARAMETERS WERE TAKEN FROM THE RECOMMENDED DATA OF BNL/1/ AND
   THE DATA FOR A NEGATIVE RESONANCE WERE ADDED SO AS TO REPRODUCE
   THE RECOMMENDED THERMAL CROSS SECTIONS FOR CAPTURE AND SCATTER-
   ING/1/.
   THE SCATTERING RADIUS WAS ASSUMED TO BE 4.3 FERMI.
   CALCULATED 2200 M/SEC CROSS SECTIONS AND RESONANCE INTEGRALS
   ARE AS FOLLOWS:
           2200 M/S CROSS SECTION(B)     RES. INTEGRAL(B)
   ELASTIC    2.83
   CAPTURE    0.038                          0.0190
   TOTAL      2.87

MF=3  NEUTRON CROSS SECTIONS
  BELOW 450 KEV, ZERO BACKGROUND CROSS SECTION WAS GIVEN AND  ALL
  THE CROSS-SECTION DATA ARE REPRODUCED FROM THE EVALUATED RESOLV-
  ED RESONANCE PARAMETERS WITH MLBW FORMULA.
  ABOVE 450 KEV, THE TOTAL AND PARTIAL CROSS SECTIONS WERE GIVEN
  POINTWISE.
 MT=1 TOTAL
  OPTICAL AND STATISTICAL MODEL CALCULATION WAS MADE WITH
  THE CASTHY CODE/2/. THE OPTICAL POTENTIAL PARAMETERS USED ARE:
    V = 49.68,               VSO = 7.12    (MEV)
   WS = 7.76 - 0.5*EN,        WV = 0       (MEV)
    R = 1.17,   RS = 1.09,  RSO = 1.17     (FM)
    A = 0.6,   ASO = 0.6,    B = 0.69      (FM)
 MT=2 ELASTIC SCATTERING
  OBTAINED BY SUBTRACTING THE SUM OF THE PARTIAL CROSS SECTIONS
  FROM THE TOTAL CROSS SECTION.
 MT=4, 51-63, 91 INELASTIC SCATTERING
  CALCULATED WITH CASTHY /2/, TAKING ACCOUNT OF THE CONTRIBUTION
  FROM THE COMPETING PROCESSES. THE DIRECT COMPONENT WAS
  CALCULATED WITH THE DWUCK CODE/3/.
  THE LEVEL DATA USED IN THE ABOVE TWO CALCULATIONS WERE TAKEN
  FROM REF./4/ AS FOLLOWS:
    MT   LEVEL ENERGY(MEV)   SPIN-PARITY
           0.0                 0+
    51     1.8087              2+
    52     2.9384              2+
    53     3.5880              0+
    54     3.9405              3+
    55     4.3180              4+
    56     4.3320              2+
    57     4.3500              3+
    58     4.8340              2+
    59     4.9000              4+
    60     4.9720              0+
    61     5.2910              2+
    62     5.4740              4+
    63     5.6900              1+
  LEVELS ABOVE 8.0 MEV WERE ASSUMED TO BE OVERLAPPING.

 MT=16, 22, 28, 103, 107     (N,2N), (N,NA), (N,NP), (N,P), (N,A)
   CALCULATED WITH THE GNASH CODE/6/ USING THE ABOVE OPTICAL
   MODEL PARAMETERS
   THE (N,A) CROSS SECTIONS WERE NORMALIZED TO THE EXPERIMENTAL
   DATA OF BORMANN/5/ AT 14 MEV.
 MT=102      CAPTURE
   CALCULATED WITH THE CASTHY CODE/2/ AND NORMALIZED TO 1.7 MB
   AT 30 KEV.
 MT=251      MU-BAR
   CALCULATED WITH THE OPTICAL MODEL.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=2
   CALCULATED WITH THE CASTHY CODE/2/.
 MT=51-63
   CALCULATED WITH THE CASTHY CODE/2/ AND THE DWUCK CODE/3/.
```

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 MT=91
   CALCULATED WITH THE CASTHY CODE/2/.
 MT=16, 22, 28
   ISOTROPIC IN THE LABORATORY SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=16, 22, 28, 91
   CALCULATED WITH THE GNASH CODE/6/.
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REFERENCES

1) MUGHABGHAB S.F. AND GARBER D.I. :"NEUTRON CROSS SECTIONS", VOL. 1, PART B (1984).
2) IGARASI S. : J. NUCL. SCI. TECH. 12, 67 (1975).
3) KUNZ P.D. : UNPUBLISHED.
4) ENSDF(EVALUATED NUCLEAR STRUCTURE DATA FILE)
5) BORMANN M. ET AL. : 1966 PARIS CONF. VOL.1, 225 (1967).
6) YOUNG P.G. AND ARTHUR E.D. : LA-6947 (1977).

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MAT number = 1325
 13-AL- 27 TIT,JAERI  EVAL-MAR88 Y.HARIMA,H.KITAZAWA,T.FUKAHORI
88MITO, 473           DIST-DEC89 REV2-DEC93
HISTORY
88-03  EVALUATION WAS PERFORMED FOR JENDL-3 BY HARIMA, KITAZAWA
       (TOKYO INSTITUTE OF TECH.) AND FUKAHORI (JAERI).  DETAILS
       ARE GIVEN IN REF./1/.
88-03  COMPILED BY FUKAHORI.
93-12  JENDL-3.2.
       COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (3,2)
      (3,66-91)            TAKEN FROM JENDL FUSION FILE*
        (3,4), (3,51-70)   CROSS-SECTION CURVES WERE SMOOTHED.
      (4,16-28), (4,91)    TAKEN FROM JENDL FUSION FILE
      (5,16-91)            TAKEN FROM JENDL FUSION FILE
      (12,51-70), (12,102)
     ***********************************************************

     --------------------------------------------------------------
      JENDL FUSION FILE /2/  (AS IS SEP. 1993)
          EVALUATED BY B.YU (CIAE) AND S.CHIBA (NDC/JAERI)
          COMPILED BY B.YU.

          CROSS SECTIONS WERE MAINLY TAKEN FROM JENDL-3.1, EXCEPT
       FOR THE (N,N') (MT=66 TO 70) AND (N,N') CONTINUUM (MT=91)
       REACTIONS WHICH WERE TAKEN FROM THE CALCULATION WITH
       SINCROS-II/3/.  ANGULAR DISTRIBUTIONS OF THESE LEVELS
       WERE TAKEN TO BE EQUAL TO THAT OF MT=66 IN JENDL-3.
          EDXS FOR MT=16, 22, 28 AND 91 WERE REPLACED BY THE
       SINCROS-II CALCULATION.  MF=6 WERE CREATED BY F15TOB
       PROGRAM.  KUMABE'S SYSTEMATICS/4/ WAS USED.  THE PRE-
       COMPOUND/COMPOUND RATIO WAS TAKEN FROM THE SINCROS-II
       CALCULATION.
          OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED
       IN THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./3/.
       LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/5/.
     --------------------------------------------------------------

MF=1  GENERAL INFORMATION
 MT=451   DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS:
 MT=151
   RESOLVED RESONANCES  : 1.0E-5 EV - 0.21 MEV
   THE RESONANCE PARAMETERS WERE SEARCHED, USING MLBW FORMULA/6/.
   AN INITIAL GUESS OF THE PARAMETERS SEARCH WAS TAKEN FROM REF.
   /7/.

    CALCULATED 2200-M/S CROSS SECTIONS AND RESONANCE INTEGRALS
                  2200-M/SEC    RES. INTEG.
      ELASTIC       1.414 B         -
      CAPTURE       0.231 B       0.123 B
      TOTAL         1.645 B         -

MF=3  NEUTRON CROSS  SECTIONS
 MT=1      TOTAL CROSS SECTION
   BETWEEN 0.21 AND 20 MEV, THE CROSS SECTIONS WERE OBTAINED BY
   AN EYE-GUIDE SO AS TO FOLLOW THE EXPERIMENTAL DATA.
 MT=2      ELASTIC SCATTERING CROSS SECTIONS
   OBTAINED BY SUBTRACTING PARTIAL CROSS SECTIONS FROM THE
   TOTAL CROSS SECTIONS.
 MT=4,51-70,91  INELASTIC SCATTERING CROSS SECTIONS
   FOR JENDL-3.1, CROSS SECTIONS UP TO 17-TH LEVEL WERE CALCULATED
   WITH THE STATISTICAL-MODEL CODE CASTHY /8/ AND THE COUPLED-
   CHANNEL MODEL CODE ECIS /9/ OR JUPITOR-1 /10/, TAKING ACCOUNT
   OF COMPETITIVE PROCESSES FOR NEUTRON, PROTON, ALPHA-PARTICLE
   AND GAMMA-RAY EMISSION/1/. THE FOLLOWING LEVELS/11/ WERE
   TAKEN INTO ACCOUNT.

          NO.   ENERGY(MEV) SPIN-PARITY
          G.S.     0.0         5/2 +
           1.      0.8438      1/2 +
           2.      1.0145      3/2 +
           3.      2.2100      7/2 +
           4.      2.7340      5/2 +
           5.      2.9814      3/2 +
           6.      3.0040      9/2 +
           7.      3.6780      1/2 +
           8.      3.9560      5/2 +
           9.      4.0540      3/2 -
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        10.       4.4090      5/2 +
        11.       4.5103     11/2 +
        12.       4.5800      7/2 +
        13.       4.8120      5/2 +
        14.       5.1550      3/2 -
        15.       5.2460      5/2 +
        16.       5.4199      5/2 +
        17.       5.4330      9/2 +

   CONTINUUM LEVELS WERE ASSUMED ABOVE 5.6 MEV.  LEVEL DENSITY WAS
   CALCULATED, USING THE GILBERT-CAMERON FORMULA.  THE LEVEL-
   DENSITY PARAMETERS WERE OBTAINED FROM A CUMULATIVE PLOT OF
   OBSERVED LEVELS/1/.

   FOR JENDL-3.2, CROSS SECTIONS FOR MT'S FROM 66 TO 70 AND CONTI-
   NUUM INELASTIC WERE REPLACED WITH JENDL FUSION FILE. THESE MT'S
   CORRESPOND TO THE FOLLOWING LEVELS.

        16.       5.4199      5/2 +
        17.       5.4328      5/2 +
        18.       5.4384      5/2 +
        19.       5.4998      7/2 +
        20.       5.5507      3/2 +
   ABOVE 5.6 MEV, CROSS SECTIONS WERE SUMMED UP AS THE CONTINUUM
   INELASTIC (MT=91).

   SEVERAL ENERGY POINTS WERE ADDED TO MT= 4, 51-70 IN ORDER TO
   SMOOTH THEIR CROSS SECTION CURVES.

 MT=16   (N,2N) CROSS SECTIONS
   CALCULATED BY THE STATISTICAL MODEL WITH THE GNASH CODE/1,12/.
 MT=22   (N,NA) CROSS SECTIONS
   CALCULATED BY THE STATISTICAL MODEL WITH THE GNASH CODE/1,12/.
   OPTICAL POTENTIAL FOR ALPHA-PARTICLES WAS DETERMINED, USING
   THE DISPERSION THEORY /13/.
 MT=28   (N,NP) CROSS SECTIONS
   CALCULATED BY THE STATISTICAL MODEL WITH THE GNASH CODE/1,12/.
 MT=102  CAPTURE
   CALCULATED WITH THE STATISTICAL-MODEL CODE CASTHY/8/ AND THE
   DIRECT-SEMIDIRECT-MODEL CODE HIKARI/14/.  THE STATISTICAL-
   MODEL CALCULATIONS WERE NORMALIZED TO 0.6 MB AT 0.6 MEV.
 MT=103  (N,P) CROSS SECTIONS
   CALCULATED BY THE STATISTICAL MODEL WITH THE GNASH CODE/1,12/.
 MT=107  (N,A) CROSS SECTIONS
   OBTAINED BY AN EYE-GUIDE TO FOLLOW OBSERVED VALUES /15/.
 MT=111  (N,2P) CROSS SECTIONS
   CALCULATED BY THE STATISTICAL MODEL WITH THE GNASH CODE/1,12/.
 MT=251  MU-BAR
   CALCULATED WITH STATISTICAL-MODEL CODE CASTHY /1,8/.

MF=4    ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=2
   CALCULATED WITH THE STATISTICAL-MODEL CODE CASTHY /1,8/.
 MT=16,22,28
   TAKEN FROM JENDL FUSION FILE.
 MT=51-66
   INCOHERENT SUM OF THE STATISTICAL MODEL AND COUPLED-CHANNEL
   MODEL CALCULATIONS/1/.  CALCULATED WITH CASTHY AND ECIS OR
   JUPITOR-1.
 MT=67-70
   ASSUMED TO BE THE SAME AS MT=66.
 MT=91
   TAKEN FROM JENDL FUSION FILE.

MF=5    ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=16,22,28,91
   TAKEN FROM JENDL FUSION FILE.

MF=12   GAMMA-RAY MULTIPLICITIES (BELOW 5.80993 MEV)
 MT=51-70
   MULTIPLICITIES WERE CALCULATED FROM TRANSITION PROBABILITIES.
 MT=102
   CALCULATED FROM ENERGY BALANCE.
 MT=103,107
   CALCULATED BY USING THE GNASH CODE/1,12/.

MF=13   GAMMA-RAY PRODUCTION CROSS SECTIONS (ABOVE 5.80993 MEV)
 MT=3
   CALCULATED BY THE STATISTICAL MODEL AND COUPLED-CHANNEL MODEL,
   USING THE GNASH CODE /12/ AND THE ECIS /9/ OR JUPITOR-1 CODE
   /10/.  BRANCHING RATIOS FOR TRANSITIONS BETWEEN DISCRETE LEVELS
   WERE TAKEN FROM REF./3/.  GAMMA-RAY TRANSITION STRENGTH IN THE
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   CONTINUUM WAS CALCULATED BY THE BRINK-AXEL GIANT RESONANCE
   MODEL FOR E1 TRANSITION AND BY THE WEISSKOPF SINGLE-PARTICLE
   MODEL FOR E2 AND M1 TRANSITION/1/.

MF=14   GAMMA-RAY ANGULAR DISTRIBUTIONS
 MT=3,51-70,102,103,107
   ISOTROPIC DISTRIBUTION WAS ASSUMED.

MF=15   GAMMA-RAY SPECTRA
 MT=3,102,103,107
   CALCULATED WITH THE GNASH CODE/1,12/
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14) KITAZAWA H.: COMPUTER PROGRAM HIKARI FOR DIRECT-SEMIDIRECT
    CAPTURE CALCULATIONS, 1980 (UNPUBLISHED).
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MAT number = 1400

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 14-SI-  0 TIT,JAERI  EVAL-MAR88 H.KITAZAWA,Y.HARIMA,T.FUKAHORI
                      DIST-SEP89 REV2-NOV93
HISTORY
88-03  NEW EVALUATION WAS PERFORMED FOR JENDL-3 BY KITAZAWA,
       HARIMA (TOKYO INSTITUTE OF TECH.) AND FUKAHORI (JAERI).
       DETAILS ARE GIVEN IN REF./1/.
88-03  COMPILED BY FUKAHORI.
93-11  JENDL-3.2
       COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (3,2)                EFFECTS OF MODIFICATION OF INELASTIC
                           SCATTERING CROSS SECTIONS.
      (3,4), (3,51-89)     CROSS-SECTION CURVES WERE SMOOTHED.
      (4,16-28), (4,91)    TAKEN FROM JENDL FUSION FILE
      (5,16-91)            TAKEN FROM JENDL FUSION FILE
      (12,51-71)           UPPER BOUNDARIES OF ENERGY RANGE WHERE
                           MULTIPLICITIES ARE GIVEN.
      (12,102)             FROM ENERGY BALANCE
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      JENDL FUSION FILE /2/  (AS OF NOV. 1993)
          EVALUATED AND COMPILED BY S.CHIBA (NDC/JAERI)

          ALL CROSS SECTION DATA, ANGULAR DISTRIBUTIONS OF
       DISCRETE LEVELS AND ENERGY DISTRIBUTIONS WERE TAKEN FROM
       JENDL-3.1.  THE ENERGY DISTRIBUTIONS WERE MODIFIED TO A
       SINGLE TABLE TYPE DISTRIBUTION.  MF=6 OF MT=16, 22, 28, AND
       91 WERE CREATED BY F15TOB PROGRAM/2/ BY USING KUMABE'S
       SYSTEMATICS/3/.  THE PRECOMPOUND/COMPOUND RATIO WAS TAKEN
       FROM THE SINCROS-II CALCULATION/4/.
          OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED
       IN THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./4/.
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MF=1  GENERAL INFORMATION
 MT=451   DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS:
 MT=151
   RESOLVED RESONANCES  : 1.0E-5 EV - 1.81 MEV
   THE RESONANCE PARAMETERS WERE SEARCHED, USING MLBW FORMULA/5/.
   AN INITIAL GUESS OF THE PARAMETERS SEARCH WAS TAKEN FROM REF.
   /6/.

    CALCULATED 2200-M/S CROSS SECTIONS AND RESONANCE INTEGRALS
                  2200-M/SEC    RES. INTEG.
      ELASTIC       2.172 B          -
      CAPTURE       0.171 B       0.104 B
      TOTAL         2.343 B          -

MF=3  NEUTRON CROSS  SECTIONS

 MT=1      TOTAL CROSS SECTION
   BETWEEN 1.81 AND 12.5 MEV, THE CROSS SECTIONS WERE OBTAINED BY
   AN EYE-GUIDE SO AS TO FOLLOW MAINLY THE EXPERIMENTAL DATA OF
   CIERJACKS ET AL./7/  ABOVE 12.5 MEV, THE CROSS SECTIONS WERE
   CALCULATED WITH THE STATISTICAL-MODEL CODE CASTHY./1,8/

 MT=2      ELASTIC SCATTERING CROSS SECTIONS
   OBTAINED BY SUBTRACTING PARTIAL CROSS SECTIONS FROM THE
   TOTAL CROSS SECTIONS.

 MT=4,51-90,91  INELASTIC SCATTERING CROSS SECTIONS
   CALCULATED WITH THE STATISTICAL-MODEL CODE CASTHY /8/ AND THE
   COUPLED-CHANNEL MODEL CODE ECIS /9/ OR JUPITOR-1 /10/, TAKING
   ACCOUNT OF COMPETITIVE PROCESSES FOR NEUTRON, PROTON, ALPHA-
   PARTICLE AND GAMMA-RAY EMISSION./1/ BELOW 11 MEV, THE IMAGINARY
   POTENTIAL STRENGTH OF THE NEUTRON SPHERICAL OPTICAL POTENTIAL
   WAS MODIFIED FROM THAT IN REF./1/ TO BE W = 1.09 + 0.55*E
   (MEV).

   LEVEL SCHEME WAS TAKEN FROM REF./11/.

      SI-28                SI-29                SI-30
   ENERGY(MEV) J-PI   ENERGY(MEV) J-PI   ENERGY(MEV) J-PI
     0.0        0 +      0.0       1/2+     0.0        0 +
     1.7789     2 +      1.2733    3/2+     2.2355     2 +
     4.6178     4 +      2.4256    3/2+     3.7696     1 +
     4.9791     0 +      3.6235    7/2-     4.8090     2 +
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6.2765     3 +      4.7410     9/2+      5.2300     3 +
6.6914     0 +      4.8950     5/2+      5.3720     0 +
6.8786     3 -      5.2546     9/2-      5.6130     2 +
6.8888     4 +      5.6520     9/2+      6.5030     4 -
7.3807     2 +      5.9490     3/2+      6.6340     2 -
7.4173     2 +      6.1910     7/2-      6.7447     1 -
7.7988     3 +      6.4240     7/2+      6.9140     2 +
7.9334     2 +      6.5220     3/2+
8.2590     2 +      6.6970     3/2-
8.3280     1 +      6.7150     3/2+
8.4133     4 -      6.9070     1/2-
8.5430     6 +
8.5890     3 +

   Q-VALUES GIVEN IN JENDL-3.2 WERE SLIGHTLY CHANGED TO BE
   CONSISTENT WITH AWR AND THRESHOLD ENERGIES.

 CONTINUUM LEVELS WERE ASSUMED ABOVE 6.999 MEV.  LEVEL DENSITY
 WAS CALCULATED, USING THE GILBERT-CAMERON FORMULA.  THE LEVEL
 DENSITY PARAMETERS WERE OBTAINED FROM A CUMULATIVE PLOT OF
 OBSERVED LEVELS./1/.

 FOR JENDL-3.2, CROSS SECTIONS AT THRESHOLD ENERGIES OF THE
 LEVELS WERE INSERTED BY INTERPOLATING THE CALCULATED CROSS
 SECTIONS.

MT=16   (N,2N) CROSS SECTIONS
 CALCULATED BY THE STATISTICAL MODEL, USING THE GNASH CODE./1,
 12/ BELOW 11 MEV, THE IMAGINARY POTENTIAL STRENGTH OF THE
 NEUTRON SPHERICAL OPTICAL POTENTIAL WAS MODIFIED FROM THAT IN
 REF./1/ TO BE W = 1.09 + 0.55*E (MEV).

MT=22   (N,NA) CROSS SECTIONS
 CALCULATED BY THE STATISTICAL MODEL, USING THE GNASH CODE./1,
 12/ OPTICAL POTENTIAL FOR ALPHA-PARTICLES WAS DETERMINED, USING
 THE DISPERSION THEORY./13/

MT=28   (N,NP) CROSS SECTIONS
 CALCULATED BY THE STATISTICAL MODEL, USING THE GNASH
 CODE/1,12/.

MT=102  CAPTURE
 CALCULATED WITH THE STATISTICAL-MODEL CODE CASTHY /8/ AND THE
 DIRECT-SEMIDIRECT-MODEL CODE HIKARI /14/.  Q-VALUE WAS
 DETERMINED AS A MEAN VALUE OF THOSE OF ISOTOPES.

MT=103  (N,P) CROSS SECTIONS
 CALCULATED BY THE STATISTICAL MODEL, USING THE GNASH CODE./1,
 12/ THE IMAGINARY POTENTIAL STRENGTH OF THE PROTON SPHERICAL
 OPTICAL MODEL WAS MODIFIED FROM THAT IN REF./1/ TO BE W = 11.0
 MEV BETWEEN 11 AND 20 MEV AND W = 8.8 + 0.2*E (MEV) BELOW 11
 MEV.

MT=107  (N,A) CROSS SECTIONS
 CNSTRUCTED FROM THE ISOTOPIC DATA.

MT=111  (N,2P) CROSS SECTIONS
 CALCULATED BY THE STATISTICAL MODEL, USING THE GNASH CODE./1,
 12/

MT=251  MU-BAR
 CALCULATED WITH STATISTICAL-MODEL CODE CASTHY /1,8/.

MF=4    ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=2
 CALCULATED WITH THE STATISTICAL-MODEL CODE CASTHY /1,8/.
MT=51-90
 INCOHERENT SUM OF THE STATISTICAL MODEL AND COUPLED-CHANNEL
 MODEL CALCULATIONS./1/  CALCULATED WITH CASTHY AND ECIS OR
 JUPITOR-1.
MT=16,22,28,91
 TAKEN FROM JENDL FUSION FILE, AND TRANSFORMED INTO THE LAB.
 SYSTEM.

MF=5    ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=16,22,28,91
 TAKEN FROM JENDL FUSION FILE, AND TRANSFORMED INTO THE LAB.
 SYSTEM.

MF=12   GAMMA-RAY MULTIPLICITIES (BELOW 9.22087 MEV)
MT=51-90,103,107
 CALCULATED BY USING THE GNASH CODE./1,12/
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 MT=102
   FROM ENERGY BALANCE.

MF=13   GAMMA-RAY PRODUCTION CROSS SECTIONS
 MT=3 (ABOVE 9.22087 MEV)
   CALCULATED BY THE STATISTICAL MODEL AND COUPLED-CHANNEL MODEL,
   USING THE GNASH CODE /12/ AND THE ECIS /9/ OR JUPITOR-1 CODE
   /10/.  BRANCHING RATIOS FOR TRANSITIONS BETWEEN DISCRETE LEVELS
   WERE TAKEN FROM REF./11/.  GAMMA-RAY TRANSITION STRENGTH IN THE
   CONTINUUM WAS CALCULATED BY THE BRINK-AXEL GIANT RESONANCE
   MODEL FOR E1 TRANSITION AND BY THE WEISSKOPF SINGLE-PARTICLE
   MODEL FOR E2 AND M1 TRANSITION./1/

MF=14   GAMMA-RAY ANGULAR DISTRIBUTIONS
 MT=3,51-90,102,103,107
   ISOTROPIC DISTRIBUTION WAS ASSUMED.

MF=15   GAMMA-RAY SPECTRA
 MT=3,102,103,107
   CALCULATED WITH THE GNASH CODE./1,12/
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    CAPTURE CALCULATIONS, 1980 (UNPUBLISHED).
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MAT number = 1425
 14-SI- 28 TIT,JAERI  EVAL-MAR88 H.KITAZAWA,Y.HARIMA,T.FUKAHORI
                      DIST-SEP89 REV2-JAN94
HISTORY
88-03  NEW EVALUATION WAS PERFORMED FOR JENDL-3 BY KITAZAWA,
       HARIMA (TOKYO INSTITUTE OF TECH.) AND FUKAHORI (JAERI).
       DETAILS ARE GIVEN IN REF./1/.
88-03  COMPILED BY FUKAHORI.
94-01  JENDL-3.2.
       COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (3,2)                 EFFECTS OF MODIFICATION OF INELASTIC
                            SCATTERING CROSS SECTIONS.
      (3,4), (3,51-66)      CROSS-SECTION CURVES WERE SMOOTHED.
      (4,16-28), (4,91)     TAKEN FROM JENDL FUSION FILE
      (5,16-91)             TAKEN FROM JENDL FUSION FILE
      (12,102)
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      JENDL FUSION FILE /2/  (AS OF JAN. 1994)
          EVALUATED AND COMPILED BY S.CHIBA (NDC/JAERI)

          CROSS SECTIONS, ANGULAR DISTRIBUTIONS AND ENERGY DISTRI-
       BUTIONS WERE TAKEN FROM JENDL-3.1.  MF=6 OF MT=16, 22, 28,
       AND 91 WERE CREATED BY F15TOB PROGRAM/2/ BY USING KUMABE'S
       SYSTEMATICS/3/.  THE PRECOMPOUND/COMPOUND RATIO WAS TAKEN
       FROM THE SINCROS-II CALCULATION/4/.
          OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED
       IN THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./4/.
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MF=1  GENERAL INFORMATION
 MT=451   DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS:
 MT=151
   RESOLVED RESONANCES  : 1.0E-5 EV - 1.81 MEV
   THE RESONANCE PARAMETERS WERE SEARCHED, USING MLBW FORMULA.
   AN INITIAL GUESS OF THE PARAMETERS WAS TAKEN FROM REF./5/.

    CALCULATED 2200-M/S CROSS SECTIONS AND RESONANCE INTEGRALS
                  2200-M/SEC    RES. INTEG.
      ELASTIC       2.149 B          -
      CAPTURE       0.177 B        0.085 B
      TOTAL         2.325 B          -

MF=3  NEUTRON CROSS  SECTIONS
 MT=1       TOTAL CROSS SECTION
   BETWEEN 1.81 AND 12.5 MEV, THE CROSS SECTIONS WERE OBTAINED BY
   AN EYE-GUIDE SO AS TO FOLLOW THE EXPERIMENTAL DATA.  ABOVE 12.5
   MEV, THE CROSS SECTIONS WERE CALCULATED WITH THE STATISTICAL-
   MODEL CODE CASTHY./1,6/

 MT=2       ELASTIC SCATTERING CROSS SECTIONS
   OBTAINED BY SUBTRACTING PARTIAL CROSS SECTIONS FROM THE TOTAL
   CROSS SECTIONS.

 MT=4,51-66,91  INELASTIC SCATTERING CROSS SECTIONS
   CALCULATED WITH THE STATISTICAL-MODEL CODE CASTHY /6/ AND THE
   COUPLED-CHANNEL MODEL CODE ECIS /7/ OR JUPITOR-1 /8/, TAKING
   ACCOUNT OF COMPETITIVE PROCESSES FOR NEUTRON, PROTON, ALPHA-
   PARTICLE AND GAMMA-RAY EMISSION./1/ BELOW 11 MEV, THE IMAGINARY
   POTENTIAL STRENGTH OF THE NEUTRON SPHERICAL OPTICAL POTENTIAL
   WAS MODIFIED FROM THAT IN REF./1/ TO BE W = 1.09 + 0.55*E
   (MEV).

   LEVEL SCHEME WAS TAKEN FROM REF./9/.
         NO.   ENERGY(MEV)  SPIN-PARITY
         G.S.    0.0          0 +
           1.    1.7789       2 +
           2.    4.6178       4 +
           3.    4.9791       0 +
           4.    6.2765       3 +
           5.    6.6914       0 +
           6.    6.8786       3 -
           7.    6.8888       4 +
           8.    7.3807       2 +
           9.    7.4173       2 +
          10.    7.7988       3 +
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         11.     7.9334        2 +
         12.     8.2590        2 +
         13.     8.3280        1 +
         14.     8.4133        4 -
         15.     8.5430        6 +
         16.     8.5890        3 +

  CONTINUUM LEVELS WERE ASSUMED ABOVE 8.9 MEV.  LEVEL DENSITY WAS
  CALCULATED, USING THE GILBERT-CAMERON FORMULA.  THE LEVEL
  DENSITY PARAMETERS WERE OBTAINED FROM A CUMULATIVE PLOT OF
  OBSERVED LEVELS/1/.

  FOR JENDL-3.2, CROSS SECTIONS AT THRESHOLD ENERGIES OF THE
  LEVELS WERE INSERTED BY INTERPOLATING THE CALCULATED CROSS
  SECTIONS.

 MT=16   (N,2N) CROSS SECTIONS
  CALCULATED BY THE STATISTICAL MODEL, USING THE GNASH
  CODE/1,10/.  BELOW 11 MEV, THE IMAGINARY POTENTIAL STRENGTH OF
  THE NEUTRON SPHERICAL OPTICAL POTENTIAL WAS MODIFIED FROM THAT
  IN REF./1/ TO BE W = 1.09 + 0.55*E (MEV).

 MT=22   (N,NA) CROSS SECTIONS
  CALCULATED BY THE STATISTICAL MODEL, USING THE GNASH
  CODE/1,10/.  OPTICAL POTENTIAL FOR ALPHA-PARTICLES WAS
  DETERMINED, USING THE DISPERSION THEORY./11/

 MT=28   (N,NP) CROSS SECTIONS
  CALCULATED BY THE STATISTICAL MODEL, USING THE GNASH CODE.

 MT=102  CAPTURE
  CALCULATED WITH THE STATISTICAL-MODEL CODE CASTHY /6/ AND THE
  DIRECT-SEMIDIRECT-MODEL CODE HIKARI /12/.  THE STATISTICAL-
  MODEL CALCULATIONS WERE NORMALIZED TO 0.6 MB AT 2.0 MEV.

 MT=103  (N,P) CROSS SECTIONS
  CALCULATED BY THE STATISTICAL MODEL, USING THE GNASH CODE.  THE
  IMAGINARY POTENTIAL STRENGTH OF THE PROTON SPHERICAL OPTICAL
  MODEL WAS MODIFIED FROM THAT IN REF./1/ TO BE W = 11.0 MEV
  BETWEEN 11 AND 20 MEV AND W = 8.8 + 0.2*E (MEV) BELOW 11 MEV.
  THE STRENGTH WAS DETERMINED SO AS TO REPRODUCE OBSERVED VALUES
  /13/.

 MT=107  (N,A) CROSS SECTIONS
  CALCULATED BY THE STATISTICAL MODEL, USING THE GNASH CODE.
  OPTICAL POTENTIAL FOR ALPHA-PARTICLES WAS DETERMINED, USING
  THE DISPERSION THEORY/11/.

 MT=111  (N,2P) CROSS SECTIONS
  CALCULATED BY THE STATISTICAL MODEL, USING THE GNASH CODE.

 MT=251  MU-BAR
  CALCULATED WITH STATISTICAL-MODEL CODE CASTHY /1,6/.

MF=4    ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=2
  CALCULATED WITH THE STATISTICAL-MODEL CODE CASTHY /1,6/.
 MT=51-66
  INCOHERENT SUM OF THE STATISTICAL MODEL AND COUPLED-CHANNEL
  MODEL CALCULATIONS./1/  CALCULATED WITH CASTHY AND ECIS OR
  JUPITOR-1.
 MT=16,22,28,91
  TAKEN FROM JENDL FUSION FILE.

MF=5    ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=16,22,28,91
  TAKEN FROM JENDL FUSION FILE.

MF=12   GAMMA-RAY MULTIPLICITIES (BELOW 9.22088 MEV)
 MT=51-66,102,103,107
  CALCULATED BY USING THE GNASH CODE/1,10/.  MULTIPLICITIES OF
  MT=102 WERE DETERMINED FROM ENERGY BALANCE.

MF=13   GAMMA-RAY PRODUCTION CROSS SECTIONS (ABOVE 9.22088 MEV)
 MT=3
  CALCULATED BY THE STATISTICAL MODEL AND COUPLED-CHANNEL MODEL,
  USING THE GNASH CODE /10/ AND THE ECIS /7/ OR JUPITOR-1 CODE
  /8/.  BRANCHING RATIOS FOR TRANSITIONS BETWEEN DISCRETE LEVELS
  WERE TAKEN FROM REF./9/.  GAMMA-RAY TRANSITION STRENGTH IN
  THE CONTINUUM WAS CALCULATED BY THE BRINK-AXEL GIANT RESONANCE
  MODEL FOR E1 TRANSITION AND BY THE WEISSKOPF SINGLE-PARTICLE
  MODEL FOR E2 AND M1 TRANSITION./1/
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MF=14   GAMMA-RAY ANGULAR DISTRIBUTIONS
 MT=3,51-66,102,103,107
   ISOTROPIC DISTRIBUTION WAS ASSUMED.

MF=15   GAMMA-RAY SPECTRA
 MT=3,102,103,107
   CALCULATED WITH THE GNASH CODE./1,10/
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REFERENCES


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 1) KITAZAWA H. ET AL.: PROC. INT. CONF. NUCLEAR DATA FOR SCIENCE
    AND TECHNOLOGY, MITO, 1988, P.473, (1988).
 2) CHIBA S. ET AL.: JAERI-M 92-027, P.35 (1992).
 3) KUMABE I. ET AL.: NUCL. SCI. ENG., 104, 280 (1990).
 4) YAMAMURO N.: JAERI-M 90-006 (1990).
 5) MUGHABGHAB S.F. ET AL.: "NEUTRON CROSS SECTIONS, VOL. 1 PART
    A", ACADEMIC PRESS (1981).
 6) IGARASI S. AND FUKAHORI T.: JAERI 1321 (1991).
 7) RAYNAL J.: COMPUTER PROGRAM ECIS79 FOR COUPLED-CHANNEL
    CALCULATIONS, 1979 (UNPUBLISHED).
 8) TAMURA T.: REV. MOD. PHYS., 37, 679 (1965).
 9) ENDT P.M. AND VAN DER LEUN C.: NUCL. PHYS., A310, 1 (1978).
10) YOUNG P.G. AND ARTHUR E.D.: LA-6947 (1977).
11) KITAZAWA H. ET AL.: UNPUBLISHED.
12) KITAZAWA H.: COMPUTER PROGRAM HIKARI FOR DIRECT-SEMIDIRECT
    CAPTURE CALCULATIONS, 1980 (UNPUBLISHED).
13) IKEDA Y.: JAERI 1312 (1988).
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MAT number = 1428

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 14-SI- 29 TIT,JAERI  EVAL-MAR88 H.KITAZAWA,Y.HARIMA,T.FUKAHORI
                      DIST-SEP89 REV2-JAN94
HISTORY
88-03  NEW EVALUATION WAS PERFORMED FOR JENDL-3 BY KITAZAWA,
       HARIMA (TOKYO INSTITUTE OF TECH.) AND FUKAHORI (JAERI).
       DETAILS ARE GIVEN IN REF./1/.
88-03  COMPILED BY FUKAHORI.
94-01  JENDL-3.2.
       COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (3,2)                 EFFECTS OF MODIFICATION OF INELASTIC
                            SCATTERING CROSS SECTIONS.
      (3,4), (3,51-79)      CROSS-SECTION CURVES WERE SMOOTHED.
      (4,16-28), (4,91)     TAKEN FROM JENDL FUSION FILE
      (5,16-91)             TAKEN FROM JENDL FUSION FILE
      (12,102)              BELOW 2 MEV.
     ***********************************************************

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      JENDL FUSION FILE /2/  (AS OF JAN. 1994)
          EVALUATED AND COMPILED BY S.CHIBA (NDC/JAERI)

          CROSS SECTIONS, ANGULAR DISTRIBUTIONS AND ENERGY DISTRI-
       BUTIONS WERE TAKEN FROM JENDL-3.1.  MF=6 OF MT=16, 22, 28,
       AND 91 WERE CREATED BY F15TOB PROGRAM/2/ BY USING KUMABE'S
       SYSTEMATICS/3/.  THE PRECOMPOUND/COMPOUND RATIO WAS TAKEN
       FROM THE SINCROS-II CALCULATION/4/.
          OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED
       IN THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./4/.
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MF=1  GENERAL INFORMATION
 MT=451   DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS:
 MT=151
   RESOLVED RESONANCES  : 1.0E-5 EV - 0.1 MEV
   THE RESONANCE PARAMETERS WERE SEARCHED, USING MLBW FORMULA.
   AN INITIAL GUESS OF THE PARAMETERS WAS TAKEN FROM REF./5/.

     CALCULATED 2200-M/S CROSS SECTIONS AND RESONANCE INTEGRALS
                  2200-M/SEC    RES. INTEG.
      ELASTIC       2.843 B          -
      CAPTURE       0.101 B       0.067 B
      TOTAL         2.944 B          -

MF=3  NEUTRON CROSS  SECTIONS
 MT=1       TOTAL CROSS SECTION
   ABOVE 0.1 MEV, THE CROSS SECTIONS WERE CALCULATED WITH THE
   STATISTICAL-MODEL CODE CASTHY./1,6/

 MT=2       ELASTIC SCATTERING CROSS SECTIONS
   OBTAINED BY SUBTRACTING PARTIAL CROSS SECTIONS FROM THE TOTAL
   CROSS SECTIONS.

 MT=4,51-79,91  INELASTIC SCATTERING CROSS SECTIONS
   CALCULATED WITH THE STATISTICAL-MODEL CODE CASTHY /6/ AND THE
   COUPLED-CHANNEL MODEL CODE ECIS /7/, TAKING ACCOUNT OF
   COMPETITIVE PROCESSES FOR NEUTRON, PROTON, ALPHA-PARTICLE AND
   GAMMA-RAY EMISSION./1/ BELOW 11 MEV, THE IMAGINARY POTENTIAL
   STRENGTH OF THE NEUTRON SPHERICAL OPTICAL POTENTIAL WAS
   MODIFIED FROM THAT IN REF./1/ TO BE W = 1.09 + 0.55*E (MEV).

   LEVEL SCHEME WAS TAKEN FROM REF./8/.
          NO. ENERGY(MEV)  SPIN-PARITY
         G.S.    0.0         1/2 +
           1.    1.2730      3/2 +
           2.    2.0280      5/2 +
           3.    2.4250      3/2 +
           4.    3.0670      5/2 +
           5.    3.6240      7/2 -
           6.    4.0800      7/2 +
           7.    4.7410      9/2 +
           8.    4.8400      1/2 +
           9.    4.8950      5/2 +
          10.    4.9340      3/2 -
          11.    5.2550      9/2 -
          12.    5.2860      7/2 +
          13.    5.6520      9/2 +
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          14.     5.8130      7/2 +
          15.     5.9490      3/2 +
          16.     6.1070      5/2 +
          17.     6.1920      7/2 -
          18.     6.3780      1/2 -
          19.     6.4230      7/2 +
          20.     6.4960      1/2 +
          21.     6.5220      3/2 +
          22.     6.6150      9/2 +
          23.     6.6970      3/2 -
          24.     6.7100      5/2 +
          25.     6.7150      3/2 +
          26.     6.7820     11/2 -
          27.     6.9070      1/2 -
          28.     6.9210      7/2 +
          29.     7.0140      5/2 -

   CONTINUUM LEVELS WERE ASSUMED ABOVE 7.057 MEV.  LEVEL DENSITY
   WAS CALCULATED, USING THE GILBERT-CAMERON FORMULA.  THE LEVEL
   DENSITY PARAMETERS WERE OBTAINED FROM A CUMULATIVE PLOT OF
   OBSERVED LEVELS./1/.

   FOR JENDL-3.2, CROSS SECTIONS AT THRESHOLD ENERGIES OF THE
   LEVELS WERE INSERTED BY INTERPOLATING THE CALCULATED CROSS
   SECTIONS.

  MT=16   (N,2N) CROSS SECTIONS
   CALCULATED BY THE STATISTICAL MODEL, USING THE GNASH CODE./1,
   9/ BELOW 11 MEV, THE IMAGINARY POTENTIAL STRENGTH OF THE
   NEUTRON SPHERICAL OPTICAL POTENTIAL WAS MODIFIED FROM THAT IN
   REF./1/ TO BE W = 1.09 + 0.55*E (MEV).

  MT=22   (N,NA) CROSS SECTIONS
   CALCULATED BY THE STATISTICAL MODEL, USING THE GNASH CODE.
   OPTICAL POTENTIAL FOR ALPHA-PARTICLES WAS DETERMINED, USING
   THE DISPERSION THEORY./10/

  MT=28   (N,NP) CROSS SECTIONS
   CALCULATED BY THE STATISTICAL MODEL, USING THE GNASH CODE.

  MT=102  CAPTURE
   CALCULATED WITH THE STATISTICAL-MODEL CODE CASTHY /6/ AND THE
   DIRECT-SEMIDIRECT-MODEL CODE HIKARI /11/.  THE STATISTICAL-
   MODEL CALCULATIONS WERE NORMALIZED TO 0.6 MB AT 0.1 MEV.

  MT=103  (N,P) CROSS SECTIONS
   CALCULATED BY THE STATISTICAL MODEL, USING THE GNASH CODE.
   THE IMAGINARY POTENTIAL STRENGTH OF THE PROTON SPHERICAL
   OPTICAL MODEL WAS MODIFIED FROM THAT IN REF./1/ TO BE W = 11.0
   MEV BETWEEN 11 AND 20 MEV AND W = 8.8 + 0.2*E (MEV) BELOW 11
   MEV.  THE STRENGTH WAS DETERMINED SO AS TO REPRODUCE OBSERVED
   VALUES /12/.

  MT=107  (N,A) CROSS SECTIONS
   CALCULATED BY THE STATISTICAL MODEL, USING THE GNASH CODE.
   OPTICAL POTENTIAL FOR ALPHA-PARTICLES WAS DETERMINED, USING
   THE DISPERSION THEORY./10/

  MT=111  (N,2P) CROSS SECTIONS
   CALCULATED BY THE STATISTICAL MODEL, USING THE GNASH CODE.

  MT=251  MU-BAR
   CALCULATED WITH STATISTICAL-MODEL CODE CASTHY /1,6/.

 MF=4    ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2
   CALCULATED WITH THE STATISTICAL-MODEL CODE CASTHY /1,6/.
  MT=51-79
   INCOHERENT SUM OF THE STATISTICAL MODEL AND COUPLED-CHANNEL
   MODEL CALCULATIONS./1/  CALCULATED WITH CASTHY AND ECIS.
  MT=16,22,28,91
   TAKEN FROM JENDL FUSION FILE.

 MF=5    ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,22,28,91
   TAKEN FROM JENDL FUSION FILE.

 MF=12   GAMMA-RAY MULTIPLICITIES  (BELOW 7.30265 MEV)
  MT=51-79,102,103,107
   CALCULATED BY USING THE GNASH CODE/1,9/.  MULTIPLICITIES OF
   MT=102 WERE DETERMINED FROM ENERGY BALANCE.
```

MF=13   GAMMA-RAY PRODUCTION CROSS SECTIONS (ABOVE 7.30265 MEV)
 MT=3
   CALCULATED BY THE STATISTICAL MODEL AND COUPLED-CHANNEL MODEL, USING THE GNASH CODE /9/ AND THE ECIS /7/ CODE. BRANCHING RATIOS FOR TRANSITIONS BETWEEN DISCRETE LEVELS WERE TAKEN FROM REF./8/. GAMMA-RAY TRANSITION STRENGTH IN THE CONTINUUM WAS CALCULATED BY THE BRINK-AXEL GIANT RESONANCE MODEL FOR E1 TRANSITION AND BY THE WEISSKOPF SINGLE-PARTICLE MODEL FOR E2 AND M1 TRANSITION./1/

MF=14   GAMMA-RAY ANGULAR DISTRIBUTIONS
 MT=3,51-79,102,103,107
   ISOTROPIC DISTRIBUTION WAS ASSUMED.

MF=15   GAMMA-RAY SPECTRA
 MT=3,102,103,107
   CALCULATED WITH THE GNASH CODE./1,9/

REFERENCES

1) KITAZAWA H. ET AL.: PROC. INT. CONF. NUCLEAR DATA FOR SCIENCE AND TECHNOLOGY, MITO, 1988, P.473, (1988).
2) CHIBA S. ET AL.: JAERI-M 92-027, P.35 (1992).
3) KUMABE I. ET AL.: NUCL. SCI. ENG., 104, 280 (1990).
4) YAMAMURO N.: JAERI-M 90-006 (1990).
5) MUGHABGHAB S.F. ET AL.: "NEUTRON CROSS SECTIONS, VOL. 1 PART A", ACADEMIC PRESS (1981).
6) IGARASI S. AND FUKAHORI T.: JAERI 1321 (1991).
7) RAYNAL J.: COMPUTER PROGRAM ECIS79 FOR COUPLED-CHANNEL CALCULATIONS, 1979 (UNPUBLISHED).
8) ENDT P.M. AND VAN DER LEUN C.: NUCL. PHYS., A310, 1 (1978).
9) YOUNG P.G. AND ARTHUR E.D.: LA-6947 (1977).
10) KITAZAWA H. ET AL.: UNPUBLISHED.
11) KITAZAWA H.: COMPUTER PROGRAM HIKARI FOR DIRECT-SEMIDIRECT CAPTURE CALCULATIONS, 1980 (UNPUBLISHED).
12) IKEDA Y. ET AL.: JAERI 1312 (1988).

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MAT number = 1431
 14-SI- 30 TIT,JAERI  EVAL-MAR88 H.KITAZAWA,Y.HARIMA,T.FUKAHORI
                      DIST-SEP89 REV2-JAN94
HISTORY
88-03  NEW EVALUATION WAS PERFORMED FOR JENDL-3 BY KITAZAWA,
       HARIMA (TOKYO INSTITUTE OF TECH.) AND FUKAHORI (JAERI).
       DETAILS ARE GIVEN IN REF./1/.
88-03  COMPILED BY FUKAHORI.
94-01  JENDL-3.2.
       COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (3,2)                 EFFECTS OF MODIFICATION OF INELASTIC
                            SCATTERING CROSS SECTIONS.
      (3,4), (3,51-69)      CROSS-SECTION CURVES WERE SMOOTHED.
      (4,16-28), (4,91)     TAKEN FROM JENDL FUSION FILE
      (5,16-91)             TAKEN FROM JENDL FUSION FILE
      (12,102)              BELOW 2 MEV.
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      JENDL FUSION FILE /2/  (AS OF JAN. 1994)
          EVALUATED AND COMPILED BY S.CHIBA (NDC/JAERI)

          CROSS SECTIONS, ANGULAR DISTRIBUTIONS AND ENERGY DISTRI-
       BUTIONS WERE TAKEN FROM JENDL-3.1.  MF=6 OF MT=16, 22, 28,
       AND 91 WERE CREATED BY F15TOB PROGRAM/2/ BY USING KUMABE'S
       SYSTEMATICS/3/.  THE PRECOMPOUND/COMPOUND RATIO WAS TAKEN
       FROM THE SINCROS-II CALCULATION/4/.
          OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED
       IN THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./4/.
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MF=1  GENERAL INFORMATION
 MT=451   DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS:
 MT=151
   RESOLVED RESONANCES  : 1.0E-5 EV - 0.5 MEV
   THE RESONANCE PARAMETERS WERE SEARCHED, USING MLBW FORMULA.
   AN INITIAL GUESS OF THE PARAMETERS WAS TAKEN FROM REF./5/.

    CALCULATED 2200-M/S CROSS SECTIONS AND RESONANCE INTEGRALS
                  2200-M/SEC    RES. INTEG.
      ELASTIC        2.491 B          -
      CAPTURE        0.108 B       0.709 B
      TOTAL          2.598 B          -

MF=3  NEUTRON CROSS  SECTIONS
 MT=1       TOTAL CROSS SECTION
   ABOVE 0.5 MEV, THE CROSS SECTIONS WERE CALCULATED WITH THE
   STATISTICAL-MODEL CODE CASTHY./1,6/

 MT=2       ELASTIC SCATTERING CROSS SECTIONS
   OBTAINED BY SUBTRACTING PARTIAL CROSS SECTIONS FROM THE TOTAL
   CROSS SECTIONS.

 MT=4,51-69,91  INELASTIC SCATTERING CROSS SECTIONS
   CALCULATED WITH THE STATISTICAL-MODEL CODE CASTHY /6/ AND THE
   COUPLED-CHANNEL MODEL CODE ECIS /7/, TAKING ACCOUNT OF
   COMPETITIVE PROCESSES FOR NEUTRON, PROTON, ALPHA-PARTICLE AND
   GAMMA-RAY EMISSION./1/ BELOW 11 MEV, THE IMAGINARY POTENTIAL
   STRENGTH OF THE NEUTRON SPHERICAL OPTICAL POTENTIAL WAS
   MODIFIED FROM THAT IN REF./1/ TO BE W = 1.09 + 0.55*E (MEV).

   LEVEL SCHEME WAS TAKEN FROM REF./8/.
          NO. ENERGY(MEV)  SPIN-PARITY
         G.S.    0.0           0 +
           1.    2.2355        2 +
           2.    3.4982        2 +
           3.    3.7696        1 +
           4.    3.7877        0 +
           5.    4.8090        2 +
           6.    4.8305        3 +
           7.    5.2300        3 +
           8.    5.2790        4 +
           9.    5.3720        0 +
          10.    5.4876        3 -
          11.    5.6130        2 +
          12.    5.9500        4 +
          13.    6.5030        4 -
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       14.    6.5370      2 +
       15.    6.6340      2 -
       16.    6.6400      0 +
       17.    6.7447      1 -
       18.    6.8650      2 -
       19.    6.9140      2 +

  CONTINUUM LEVELS WERE ASSUMED ABOVE 6.999 MEV.  LEVEL DENSITY
  WAS CALCULATED, USING THE GILBERT-CAMERON FORMULA.  THE LEVEL
  DENSITY PARAMETERS WERE OBTAINED FROM A CUMULATIVE PLOT OF
  OBSERVED LEVELS./1/.

  FOR JENDL-3.2, CROSS SECTIONS AT THRESHOLD ENERGIES OF THE
  LEVELS WERE INSERTED BY INTERPOLATING THE CALCULATED CROSS
  SECTIONS.

 MT=16   (N,2N) CROSS SECTIONS
  CALCULATED BY THE STATISTICAL MODEL, USING THE GNASH CODE./1,
  9/ BELOW 11 MEV, THE IMAGINARY POTENTIAL STRENGTH OF THE
  NEUTRON SPHERICAL OPTICAL POTENTIAL WAS MODIFIED FROM THAT IN
  REF./1/ TO BE W = 1.09 + 0.55*E (MEV).

 MT=22   (N,NA) CROSS SECTIONS
  CALCULATED BY THE STATISTICAL MODEL, USING THE GNASH CODE.
  OPTICAL POTENTIAL FOR ALPHA-PARTICLES WAS DETERMINED, USING
  THE DISPERSION THEORY./10/

 MT=28   (N,NP) CROSS SECTIONS
  CALCULATED BY THE STATISTICAL MODEL, USING THE GNASH CODE.

 MT=102  CAPTURE
  CALCULATED WITH THE STATISTICAL-MODEL CODE CASTHY /6/ AND THE
  DIRECT-SEMIDIRECT-MODEL CODE HIKARI /11/.  THE STATISTICAL-
  MODEL CALCULATIONS WERE NORMALIZED TO 0.6 MB AT 0.5 MEV.

 MT=103  (N,P) CROSS SECTIONS
  CALCULATED BY THE STATISTICAL MODEL, USING THE GNASH CODE.  THE
  IMAGINARY POTENTIAL STRENGTH OF THE PROTON SPHERICAL OPTICAL
  MODEL WAS MODIFIED FROM THAT IN REF./1/ TO BE W = 11.0 MEV
  BETWEEN 11 AND 20 MEV AND W = 8.8 + 0.2*E (MEV) BELOW 11 MEV.

 MT=107  (N,A) CROSS SECTIONS
  CALCULATED BY THE STATISTICAL MODEL, USING THE GNASH CODE.
  OPTICAL POTENTIAL FOR ALPHA-PARTICLES WAS DETERMINED, USING
  THE DISPERSION THEORY./10/

 MT=111  (N,2P) CROSS SECTIONS
  CALCULATED BY THE STATISTICAL MODEL, USING THE GNASH CODE.

 MT=251  MU-BAR
  CALCULATED WITH STATISTICAL-MODEL CODE CASTHY /1,6/.

MF=4    ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=2
  CALCULATED WITH THE STATISTICAL-MODEL CODE CASTHY /1,6/.
 MT=51-69
  INCOHERENT SUM OF THE STATISTICAL MODEL AND COUPLED-CHANNEL
  MODEL CALCULATIONS./1/  CALCULATED WITH CASTHY AND ECIS.
 MT=16,22,28,91
  TAKEN FROM JENDL FUSION FILE.

MF=5    ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=16,22,28,91
  TAKEN FROM JENDL FUSION FILE.

MF=12   GAMMA-RAY MULTIPLICITIES (BELOW 7.23453 MEV)
 MT=51-69,102,107
  CALCULATED BY USING THE GNASH CODE/1,9/.  MULTIPLICITIES OF
  MT=102 WERE DETERMINED FROM ENERGY BALANCE.

MF=13   GAMMA-RAY PRODUCTION CROSS SECTIONS (ABOVE 7.23453 MEV)
 MT=3
  CALCULATED BY THE STATISTICAL MODEL AND COUPLED-CHANNEL MODEL,
  USING THE GNASH CODE /9/ AND THE ECIS /7/ CODE.  BRANCHING
  RATIOS FOR TRANSITIONS BETWEEN DISCRETE LEVELS WERE TAKEN FROM
  REF./8/.  GAMMA-RAY TRANSITION STRENGTH IN THE CONTINUUM WAS
  CALCULATED BY THE BRINK-AXEL GIANT RESONANCE MODEL FOR E1
  TRANSITION AND BY THE WEISSKOPF SINGLE-PARTICLE MODEL FOR E2
  AND M1 TRANSITION./1/

MF=14   GAMMA-RAY ANGULAR DISTRIBUTIONS
 MT=3,51-69,102,107
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   ISOTROPIC DISTRIBUTION WAS ASSUMED.

MF=15   GAMMA-RAY SPECTRA
 MT=3,102,107
   CALCULATED WITH THE GNASH CODE./1,9/
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REFERENCES
 1) KITAZAWA H. ET AL.: PROC. INT. CONF. NUCLEAR DATA FOR SCIENCE
    AND TECHNOLOGY, MITO, 1988, P.473, (1988).
 2) CHIBA S. ET AL.: JAERI-M 92-027, P.35 (1992).
 3) KUMABE I. ET AL.: NUCL. SCI. ENG., 104, 280 (1990).
 4) YAMAMURO N.: JAERI-M 90-006 (1990).
 5) MUGHABGHAB S.F. ET AL.: "NEUTRON CROSS SECTIONS, VOL. 1 PART
    A", ACADEMIC PRESS (1981).
 6) IGARASI S. AND FUKAHORI T.: JAERI 1321 (1991).
 7) RAYNAL J.: COMPUTER PROGRAM ECIS79 FOR COUPLED-CHANNEL
    CALCULATIONS, 1979 (UNPUBLISHED).
 8) ENDT P.M. AND VAN DER LEUN C.: NUCL. PHYS., A310, 1 (1978).
 9) YOUNG P.G. AND ARTHUR E.D.: LA-6947 (1977).
10) KITAZAWA H. ET AL.: UNPUBLISHED.
11) KITAZAWA H.: COMPUTER PROGRAM HIKARI FOR DIRECT-SEMIDIRECT
    CAPTURE CALCULATIONS, 1980 (UNPUBLISHED).
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MAT number = 1525

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 15-P - 31 FUJI E.C.  EVAL-MAY87 H.NAKAMURA
                      DIST-SEP89 REV2-DEC93
HISTORY
87-05  NEWLY EVALUATED BY H.NAKAMURA (FUJI ELECTRIC CO.LTD)
93-12  JENDL-3.2
       TOTAL CROSS SECTION WAS RECALCULATED BY T.WATANABE. (KHI)
       GAMMA-RAY PRODUCTION CROSS SECTIONS WERE EVALUATED BY
       T. ASAMI (DE).
*****  MODIFIED PARTS FOR JENDL-3.2 ******************************
(3,1)                 A NEW OMP SET WAS DETERMINED.
(3,2)                 TOTAL - NONELASTIC
(3,107)               Q-VALUE CORRECTED
MF=12,13,14,15        NEWLY EVALUATED
*****************************************************************

MF=1  GENERAL INFORMATION
            MT=451    DESCRIPTIVE DATA AND DICTIONARY

MF=2        MT=151    RESONANCE PARAMETERS:
   RESOLVED RESONANCES FOR MLBW FORMULA : 1.0E-5 EV - 500 KEV
           PARAMETERS ARE TAKEN FROM BNL 325 4TH EDITION/1/, AND
           R.L.MACKLIN ET AL./2/.
           CROSS SECTIONS CALCULATED WITH THESE PARAMETERS ARE TO
           BE CORRECTED BY ADDING MF=3, MT=1,2AND 102 DATA.

    CALCULATED 2200-M/S CROSS SECTIONS AND RESONANCE INTEGRALS
                 2200-M/SEC    RES. INTEG.  REF.
      ELASTIC      3.134 B         -         /1/
      CAPTURE      0.166 B      0.081 B      /1/
      TOTAL        3.300 B         -

MF=3  NEUTRON CROSS  SECTIONS
    BELOW 500 KEV
        BACKGROUND CROSS SECTION.
        MT=1,2   0.07029 B
        MT=251 MU-BAR=0.0217
    ABOVE 500 KEV
        MT=1     NEW OPTICAL MODEL CALCULATION USING THE PARAMETER
                 SET DETERMINED BY T. WATANABE
                     V = 50.58 - 0.06476E (MEV)
                     WS = 6.583 + 0.5927E (MEV)
                     VSO= 3.391           (MEV)
                     R = 1.36,  A = 0.422(FM)
                     RS= 1.23,  B = 0.517(FM)
                     RSO=0.938, ASO=0.600(FM)

        MT=2         TOTAL - NONELASTIC
        MT=4,51-56,91,102 TOTAL, ELASTIC, INELASTIC AND CAPTURE
        CALCULATED WITH CASTHY CODE/3/, CONSIDERING THE
        COMPETITION WITH THE THRESHOLD REACTION CHANNELS.
    OPTICAL POTENTIAL PARAMETERS OF C.Y.FU/4/ ARE ADJUSTED
    TO REPRODUCE THE FOLLOWING EXPERIMENTAL DATA:
    MT=1 TOTAL NESTOR DATA (MANY AUTHORS)
    MT=2 ELASTIC  -
    MT=4 INELASTIC  -
    THE SPHERICAL OPTICAL POTENTIAL PARAMETERS:
      V=43.0              VSO=5.37 (MEV)
      WS=9.13             WU =0.0  (MEV)
      R =RSO=1.26         RS=1.39  (FM)
      A=ASO=0.76          B=0.40   (FM)

   MT=102 CAPTURE DATA ARE NORMALIZED TO 1.8 MB AT 500 KEV
    BASED ON (7 MB AT 30 KEV) BY R.L.MACKLIN ET AL./5/.

  THE DISCRETE LEVEL SCHEME TAKEN FROM  REF./6/:
      NO.       ENERGY (MEV)      SPIN-PARITY
    (G.S.)        0.0               1/2 -
       1          1.266             3/2 +
       2          2.234             5/2 +
       3          3.134             1/2 +
       4          3.295             5/2 +
       5          3.415             7/2 +
       6          3.506             3/2 +

       CONTINUUM LEVELS ASSUMED ABOVE 4.0 MEV. THE LEVEL
       DENSITY PARAMETERS OF ASANO ET AL. /7/ ARE USED.

   MT=16(N,2N), 22(N,N'A), 28(N,N'P), 103(N,P), 107(N,A)
       BASED ON THE STATISTICAL MODEL CALCULATIONS WITH GNASH
       CODE /8/, WITHOUT THE PRECOMPOUND REACTION CORRECTION.
       TRANSMISSION COEFFICIENTS FOR PROTON AND ALPHA PARTICLE
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        ARE CALCULATED BY USING THE OMP OF BECCHETTI-GEENLEES
        /9/ AND HUIZENGA-IGO/10/, RESPECTIVELY. IN THE CASES OF
        MT=103 AND 107, THE EXPERIMENTAL DATA WERE ALSO
        CONSIDERED TOGETHER WITH THE CALCULATIONS.
        LEVEL DENSITY PARAMETERS ARE BASED ON BUILT-IN VALUES.
   MT=251 MU-BAR
         CALCULATED WITH OPTICAL MODEL (CASTHY).

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
   MT=2   CALCULATED WITH  OPTICAL MODEL(CASTHY).
   MT=51-56  CALCULATED WITH HAUSER-FESHBACH FORMULA(CASTHY)
   MT=16,22,28  ISOTROPIC IN THE LABORATORY SYSTEM.
   MT=91        ISOTROPIC DISTRIBUTIONS IN CM WERE CONVERTED TO
                THE DISTRIBUTIONS IN LAB.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
   MT=16,22,28,91,103,107   EVAPORATION SPECTRA.

MF=12 PHOTON PRODUCTION MULTIPLICITY
   MT=102,103,107           CALCULATED BY SINCROS-II/11/.

MF=13 PHOTON PRODUCTION CROSS SECTION
   MT=3                     CALCULATED BY SINCROS-II/11/.
   MT=4                     DISCRETE LINES CALCULATED BY TAKING
                            ACCOUNT OF BRANCHING RATIOS

MF=14 PHOTON ANGULAR DISTRIBUTION
   MT=3,4,102,103,107       ISOTROPIC

MF=15 PHOTON ENERGY DISTRIBUTION
   MT=3,103,107         CALCULATED BY SINCROS-II/11/.
   MT=102               CALCULATED BY CASTHY/3/.
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REFERENCES


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 1) MUGHABGHAB, S.F. ET AL.: NEUTRON CROSS SECTION, VOL.1 (1981).
 2) MACKLIN, R.L. ET AL.: PHYS. REV. C32, 379 (1985).
 3) IGARASI, S.: J. NUCL. SCI. TECH. 12, 67 (1975).
 4) FU, C.Y.: ATOM. DATA AND NUCL. DATA TABLES. 17, 127 (1976).
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 7) ASANO ET AL.: PRIVATE COMMUNICATION.
 8) YOUNG, P.G. AND ARTHUR, E.D.: LA-6947 (1977).
 9) BECCHETI, JR. AND GREENLESS, G.W.: POLARIZATION PHENOMENA
    IN NUCLEAR REACTIONS, P.682 (1971).
10) HUIZENGA, JR. AND IGO, G.J.: NUCL. PHYS. 29, 462 (1962).
11) YAMAMURO, N.: JAERI-M 90-006 (1990).
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MAT number = 1600

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 16-S -  0 FUJI E.C.  EVAL-MAY87 H.NAKAMURA
                      DIST-SEP89 REV2-FEB94
HISTORY
87-05  NEWLY EVALUATED BY H.NAKAMURA (FUJI ELECTRIC CO. LTD.)
87-07  COMPILED BY T.FUKAHORI (JAERI).
88-02  MODIFICATIONS ON (N,P) AND INELASTIC SCATTERING CROSS
      SECTIONS OF S-32. DIRECT INELASTIC COMPONENTS FROM DWBA
      CALCULATIONS WERE ADDED TO THE COMPOUND COMPONENTS AS TO
      REPRODUCE DDX DATA OF OKTAVIAN (OSA, 1986).
88-08  MODIFIED DUE TO CORRECT S-32 DATA BY T.FUKAHORI (JAERI)
94-02  JENDL-3.2
       NEW OPTICAL MODEL CALCULATION WAS PERFORMED BY T. WATANABE
       (KHI).
       GAMMA PRODUCTION DATA WERE EVALUATED BY T. ASAMI (DE).
       DATA WERE COMPILED BY K. SHIBATA (JAERI).
       *****  MODIFIED PARTS FOR JENDL-3.2 *****************
       (3,1),(3,4),(3,51-73),(3,91),(3,251),(4,2),(4,51-73)
               OPTICAL AND STATISTICAL MODEL CALCULATIONS.
               CONSTRUCTED FROM ISOTOPIC FILES.
       (3,2)   TOTAL - NONELASTIC
       (5,16-91)        SUBSECTIONS COMBINED.
       MF=12,13,14,15   GAMMA PRODUCTION DATA
       ****************************************************

 NATURAL SULPHUR DATA CONSTRUCTED FROM S-ISOTOPES.

MF=1  GENERAL INFORMATION
     MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
     MT=151  RESOLVED RESONANCES
        RESONANCE REGION : 1.0E-5 EV - 1.57 MEV
       THE MULTILEVEL BREIT-WIGNER FORMULA WAS USED. PARAMETERS
       WERE ADOPTED FROM THE FOLLOWING SOURCES.
          S-32 : -10 KEV - 1.57 MEV, R = 3.92 FM
          S-33 : -7.1 - 260 KEV, R = 3.85 FM
          S-34 : -10 - 480 KEV, R = 3.60 FM

       CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS.
                       2200-M/S      RES. INTEG.
          ELASTIC      1.024  B          -
          CAPTURE      0.514  B        0.2428 B
          TOTAL        1.546  B          -

MF=3  NEWTRON CROSS SECTIONS
       BELOW 1.57 MEV, BACKGROUND CROSS SECTIONS CONSISTING OF
       (N,P) AND (N,ALPHA) CROSS SECTIONS WERE GIVEN.

     MT=1  TOTAL
       SPHERICAL AND DEFORMED OPTICAL POTENTIAL PARAMETERS
       WERE DETERMINED SO AS TO REPRODUCE THE EXPERIMENTAL DATA
       OF CIERJACKS+/1/.  THE SHERICAL POTENTIALS WERE USED IN
       CALCULATING THE CROSS SECTIONS OF S-32, WHILE THE
       DEFORMED ONES WERE USED IN CALCULATING THE CROSS SECTIONS
       OF THE OTHER ISOTOPES. THE ISOTOPIC CALCULATIONS WERE
       PERFORMED BY USING CASTHY CODE/2/.
     MT=2  ELASTIC SCATTERING
       GIVEN AS TOTAL MINUS OTHER CROSS SECTIONS.
     MT=4  TOTAL INELASTIC SCATTERING
       SUM OF MT=51-73, 91
     MT=16,22,28,103,107
       THE WEIGHTED SUM OF ISOTOPES WAS ADOPTED. THE CROSS
       SECTIONS OF ISOTOPES WERE CALCULATED USING GNASH CODE/3/.
     MT=51-73,91  INELASTIC SCATTERING
       ISOTOPIC DATA WERE OBTAINED FROM THE CASTHY/2/
       CALCULATION.  ISOTOPIC LEVELS WERE SORTED WITH ENERGIES.
       ****************************************************
       OPTICAL-MODEL POTEMTIAL PARAMETERS USED FOR THE JENDL-3.2
       EVALUATION:
              V  = 58.83 - 0.5635EN      (MEV)
              WS = 3.609 + 0.1819EN      (MEV)
              (  = 2.518 + 0.0302EN      (MEV) FOR DEFORMED POT.)
              VSO= 4.199                 (MEV)
              R  = 1.306,  A  = 0.452     (FM)
              RS = 1.124,  B  = 0.690     (FM)
              RSO= 1.010,  ASO= 0.750     (FM).
      ******************************************************
     MT=102  CAPTURE
       ABOVE 1.57 MEV, THE CASTHY/2/ CALCULATION WAS ADOPTED.
     MT=103(N,P), 107(N,ALPHA)
       FOR S-32 THE EVALUATION WAS MADE ON THE BASIS OF
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      EXPERIMENTAL DATA.  FOR S-33,34,36, THE GNASH/3/
      CALCULATION WAS ADOPTED.
    MT=251  MU-BAR
      CALCULATED WITH CASTHY/2/.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
    MT=2,51-73
      OPTICAL AND STATISTICAL-MODEL CALCULATIONS.
    MT=16,22,28
      ASSUMED TO BE ISOTROPIC IN THE LABORATORY SYSTEM.
    MT=91
      ISOTROPIC DISTRIBUTIONS IN CM WERE CONVERTED TO THE
      DISTRIBUTIONS IN LAB.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
    MT=16,22,28,91
      CALCULATED WITH GNASH/3/.

MF=12 PHOTON PRODUCTION MULTIPLICITY
    MT=102,103,107
      CALCULATED WITH SINCROS-II/4/.

MF=13 PHOTON PRODUCTION CROSS SECTION
    MT=3
      CALCULATED WITH SINCROS-II/4/.
    MT=4
      CALCULATED BY TAKING ACCOUNT OF BRANCHING RATIOS.

MF=14 PHOTON ANGULAR DISTRIBUTION
    MT=3,4,102,103,107
      ASSUMED TO BE ISOTROPIC.

MF=15 PHOTON ENERGY DISTRIBUTION
    MT=3,102,103,107
      CALCULATED WITH SINCROS-II/4/.
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REFERENCES

1) CIERJACKS, S. ET AL.: KFK-1000 (1968)
2) IGARASI, S. : J. NUCL. SCI. TECHNOL., 12, 67 (1975).
3) YOUNG, P.G. AND ARTHUR, E.D.: LA-6947 (1977).
4) YAMAMURO, N: JAERI-M 90-006 (1990).

MAT number = 1625

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 16-S - 32 FUJI E.C.  EVAL-MAY87 H.NAKAMURA
                      DIST-SEP89 REV2-FEB94
HISTORY
87-03  NEWLY EVALUATED BY H.NAKAMURA (FUJI ELECTRIC CO.LTD.)
88-08  THE FOLLOWING QUANTITIES WERE MODIFIED BY H.NAKAMURA
           (N,P) CROSS SECTION
           INELASTIC SCATTERING CROSS SECTIONS AND ANGULAR
         DISTRIBUTIONS OF THE FIRST, THIRD AND CONTINUUM LEVELS
94-02  JENDL-3.2
       COUPLED-CHANNEL CALCULATION WAS PERFORMED BY K. SHIBATA
       (JAERI) USING THE OMP SET DETERMINED BY T. WATANABE (KHI).
       THE TOTAL AND INELASTIC SCATTERING CROSS SECTIONS WERE
       REPLACED BY THE C.C. CALCULATIONS.
       DATA WERE COMPILED BY K. SHIBATA.
*****  MODIFIED PARTS FOR JENDL-3.2 ***************************
(3,1),(3,4),(3,51-56,91),(3,251),(4,2),(4,51-56)
                    COUPLED-CHANNEL CALCULATIONS.
(3,2)               TOTAL - NONELASTIC
***************************************************************
   MF=1 GENERAL  INFORMATION
     MT=451  DESCRIPTIVE DATA AND DICTIONARY

   MF=2 MT=151 RESONANCE PARAMETERS:
   RESOLVED RESONANCES FOR MLBW FORMULA: 1.0E-5 EV - 1500 KEV
   PARAMETERS ARE TAKEN FROM BNL 325 4TH EDITION/1/, AND
   SOME PARAMETERS ARE ASSUMED TO FIT THE MEASURED DATA.
   CROSS SECTIONS CALCULATED WITH THESE PARAMETERS ARE TO
   BE CORRECTED BY ADDING MF=3, MT=1, 2 AND 102 DATA.

   CALCULATED 2200-M/S CROSS SECTIONS AND RESONANCE INTEGRALS

                 2200-M/SEC    RES. INTEG.   REF.
       ELASTIC     0.963 B          -          -
       CAPTURE     0.528 B       0.250 B      /1/
       TOTAL       1.499 B          -          -

   MF=3  NEUTRON  CROSS  SECTIONS
   BELOW  1500KEV
     BACKGROUND DATA FOR
        MT=107          0.007 B, BASED ON 2200-M/S DATA OF REF./1/.
   ABOVE 1500KEV
     MT=1, 2, 4, 51-56, 91, 102   TOTAL, ELASTIC, INELASTIC AND
     CAPTURE CALCULATED WITH CASTHY CODE /2/, CONSIDERING THE
     COMPETITION WITH THE THRESHOLD REACTION CHANNELS.
     OPTICAL POTENTIAL PARAMETERS OF C.Y.FU/3/ ARE ADJUSTED
     TO REPRODUCE THE FOLLOWING EXPERIMENTAL DATA:
     MT=1   TOTAL    -
     MT=2   ELASTIC G.A.PETITT ET AL./4/, A.VIRDIS/5/.
     MT=4   INELASTIC    -
     THE SPHERICAL OPTICAL POTENTIAL PARAMETERS:
     V=38.0       VSO=5.37 (MEV)
     WS=9.13      WV =0.0  (MEV)
     R =RSO=1.26   RS=1.39 (FM)
     A=ASO =0.76   B =0.40(FM)
     MT=102   CAPTURE DATA ARE NORMALIZED TO THE EXPERIMENTAL
     DATA OF A.LINDHOLM ET AL. AT 3 - 6 MEV/6/.

     THE DISCRETE LEVEL SCHEME TAKEN FROM REF./7/:
       NO.       ENERGY(MEV)    SPIN-PARITY
     (G.S.)        0.0             0+
        1          2.230           2+
        2          3.779           0+
        3          4.282           2+
        4          4.459           4+
        5          4.695           1+
        6          5.006           3-
     CONTINUUM LEVELS ASSUMED ABOVE 5.4 MEV. THE LEVEL
     DENSITY PARAMETERS OF ASANO ET AL./8/ARE USED.

     *****  JENDL-3.2 ***************************************
     MT=1,4,51-56,91,251
       COUPLED-CHANNEL OPTICAL AND STATISTICAL MODEL CALCULATION
       WAS PERFORMED BY USING THE OMP SET GIVEN AS FOLLOWS:
              V  = 58.83 - 0.5635EN      (MEV)
              WS = 2.518 + 0.0302EN      (MEV)
              VSO= 4.199                 (MEV)
              R  = 1.306,  A  = 0.452     (FM)
              RS = 1.124,  B  = 0.690     (FM)
              RSO= 1.010,  ASO= 0.750     (FM).
       THE COUPLING SCHEME
             GROUND STATE      0.0 MEV  (0+)
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          1 PHONON STATE    2.230 MEV (2+), 5.006 MEV (3-)
          2 PHONON STATE    3.779 MEV (0+), 4.280 MEV (2+)
                            4.459 MEV (4+)
          COUPLING CONSTANTS   BETA-2 = 0.30
                               BETA-3 = 0.25
  *********************************************************
  MT=16(N,2N), 22(N,N'A), 28(N,N'P), 103(N,P), 107(N,A)
     BASED ON THE STATISTICAL MODEL CALCULATIONS WITH GNASH
     CODE/9/, WITHOUT THE PRECOMPOUND REACTION CORRECTION.
     TRANSMISSION COEFFICIENTS FOR PROTON AND ALPHA PARTICLES
     ARE CALCULATED BY USING THE OMP OF BECCHETTI-GEENLEES
     /10/ AND HUIZENGA-IGO/11/, RESPECTIVELY.
     LEVEL DENSITY PARAMETERS ARE BASED ON BUILT-IN VALUES.

  MT=103  (N,P) CROSS SECTION
     ADJUSTED TO REPRODUCE R. RICAMO DATA ABOVE 14 MEV /12/.
  MT=251    MU-BAR
  CALCULATED WITH COUPLED-CHANNEL OPTICAL MODEL.

MF=4 ANGULAR DISTRIBUTIONS OF SECONDARY  NEUTRONS
  MT=2  CALCULATED WITH OPTICAL MODEL (CASTHY).
  MT=51-56 CALCULATED  WITH COUPLED-CHANNEL STATISTICAL MODEL
  MT=16,22,28 ISOTROPIC IN THE LABORATORY SYSTEM.
  MT=91       ISOTROPIC DISTRIBUTIONS IN CM WERE CONVERTED TO
              THE DISTRIBUTIONS IN LAB.

MF=5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,22,28,91,103,107 EVAPORATION SPECTRA,
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REFERENCES


```
 1) MUGHABGHAB,S.F. ET AL.: NEUTRON CROSS SECTION, VOL.1 (1981).
 2) IGARASI,S: J. NUCL. SCI. TECH. 12, 67 (1975).
 3) FU,C.Y.: ATOM. DATA AND NUCL. DATA TABLES. 17, 127 (1976).
 4) PETITT,G.A. ET AL.: NUCL. PHYS. 79, 231 (1960).
 5) VIRDIS,A.: CEA-R-5144 (1981).
 6) LINDHOLM,A. ET AL.: NUCL. PHYS. A279, 445 (1977).
 7) LEDER,C.M. ET AL.: TABLE OF ISOTOPES. 7TH EDIT.
 8) ASANO ET AL.: PRIVATE COMMUNICATION.
 9) YOUNG,P.G. AND ARTHUR,E.D.: LA-6947 (1977).
10) BECCHETI,JR. AND GREENLEES,G.W.: POLARIZATION PHENOMENA
   IN NUCLEAR REACTIONS, P.682 (1971).
11) HUIZENGA,JR. AND IGO,G.J.: NUCL. PHYS. 29, 462 (1962).
12) RICAMO, R. : NC. 8, 383 (1951)
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MAT number = 1628

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 16-S - 33 FUJI E.C.  EVAL-MAY87 H.NAKAMURA
                      DIST-SEP89 REV2-FEB94
HISTORY
87-05  NEWLY EVALUATED BY H.NAKAMURA (FUJI ELECTRIC CO. LTD.)
94-02  JENDL-3.2
       NEW OPTICAL MODEL CALCULATION WAS PERFORMED BY T. WATANABE
       (KHI).
       DATA WERE COMPILED BY K. SHIBATA (JAERI).
       *****  MODIFIED PARTS FOR JENDL-3.2 *****************
       (3,1),(3,4),(3,51-57),(3,91),(3,251),(4,2),(4,51-57)
              OPTICAL AND STATISTICAL MODEL CALCULATIONS.
       (3,2)    TOTAL - NONELASTIC
       ***************************************************

 MF=1 GENERAL INFORMATION
      MT=451  DESCRIPTIVE DATA AND DICTIONARY

 MF=2 MT=151  RESONANCE PARAMETERS:
      RESOLVED RESONANCES FOR MLBW FORMULA: 1.0E-5 EV - 260 KEV
     PARAMETERS ARE TAKEN FROM BNL325 4TH EDITION/1/, AND
     C.WAGEMANS AND H.WEIGMANN/2/.
      CROSS SECTIONS CALCULATED WITH THESE PARAMETERS ARE TO
     BE CORRECTED ADDING MF=3, MT=1, 2 AND 102 DATA.

     CALCULATED 2200-M/S CROSS SECTIONS AND RESONANCE INTEGRALS

                  2200-M/SEC      RES. INTEG.       REF.
       ELASTIC       2.84 B            -            /1/
       CAPTURE       0.35 B         0.164 B         /1/
       TOTAL         3.36 B            -             -

 MF=3 NEUTRON CROSS SECTIONS
    BELOW 260 KEV
      BACKGROUND CROSS SECTIONS ARE GIVEN FOR MT=1:
      MT=1 0.171B : 0.002(N,P) + 0.169(N,A) B
      MT=103 (N,P) 0.0016 B, BASED ON 2200-M/S DATA /1/.
      MT=107 (N,A) 0.169 B, SAME TO THE ABOVE.
      MT=251 MU-BAR = 0.0210
    ABOVE 260 KEV.
      MT=1,2,4,51-57,91,102
          TOTAL, ELASTIC, INELASTIC AND CAPTURE CROSS SECTIONS
         CALCULATED WITH CASTHY CODE /3/, CONSIDERING THE
         COMPETITION WITH THE THRESHOLD REACTION CHANNELS.
         OPTICAL POTENTIAL PARAMETERS OF C.Y.FU/4/ ARE ADJUSTED
         TO REPRODUCE THE FOLLOWING EXPERIMENTAL DATA:
             MT=1 TOTAL   -
             MT=2 ELASTIC CROSS SECTIONS OF S-32.
             MT=4 INELASTIC    -
          THE SPHERICAL OPTICAL POTENTIAL PARAMETERS :
             V = 38.0      VSO= 5.37    (MEV)
             WS= 9.13      WV = 0.0     (MEV)
             R=RSO= 1.26   RS = 1.39    (FM)
             A=ASO= 0.76   B  = 0.40    (FM)
          MT=102 CAPTURE DATA ARE NORMALIZED TO 0.5 MB AT 260 KEV
         BASED ON S-32 CAPTURE CROSS SECTIONS.
          THE DISCRETE LEVEL SCHEME TAKEN FROM REF./5/:
             NO.      ENERGY(MEV)      SPIN-PARITY
            (G.S.)       0.0            3/2    +
               1         0.8404         1/2    +
               2         1.966          5/2    +
               3         2.313          3/2    +
               4         2.866          5/2    +
               5         2.934          7/2    -
               6         2.969          7/2    +
               7         3.220          3/2    -
          CONTINUUM LEVELS ARE ASSUMED ABOVE 3.6MEV. THE LEVEL
         DENSITY PARAMETERS OF ASANO ET AL./6/ ARE USED.
     *****  JENDL-3.2 ************************************
     MT=1,4,51-57,91,251
       OPTICAL AND STATISTICAL MODEL CALCULATION
       WAS PERFORMED BY USING THE OMP SET GIVEN AS FOLLOWS:
              V  = 58.83 - 0.5635EN     (MEV)
              WS = 3.609 + 0.1819EN     (MEV)
              VSO= 4.199                (MEV)
              R  = 1.306,  A  = 0.452    (FM)
              RS = 1.124,  B  = 0.690    (FM)
              RSO= 1.010,  ASO= 0.750    (FM).
     *****************************************************
      MT=16(N,2N), 22(N,N'A),28(N,N'P),103(N,P),107(N,A)
          BASED ON THE STATISTICAL MODEL CALCULATIONS WITH GNASH
         CODE /7/, WITHOUT THE PRECOMPOUND REACTION CORRECTION.
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         TRANSMISSION COEFFICIENTS FOR PROTON AND ALPHA PARTICLES
         ARE CALCULATED BY USING THE OMP OF BECCHETTI-GEENLEES/8/
         AND HUIZENGA-IGO/9/, RESPECTIVELY.
          LEVEL DENSITY PARAMETERS ARE BASED ON BUILT-IN VALUES.
      MT=251 MU-BAR
          CALCULATED WITH OPTICAL MODEL (CASTHY).

 MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
      MT=2  CALCULATED WITH OPTICAL MODEL (CASTHY).
      MT=51-57  CALCULATED WITH HAUSER-FESHBACH FORMULA (CASTHY)
      MT=16,22,28  ISOTROPIC IN THE LABORATORY SYSTEM.
      MT=91        ISOTROPIC DISTRIBUTIONS IN CM WERE CONVERTED
                   TO THE DISTRIBUTIONS IN LAB.

 MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
      MT=16,22,28,91,103,107  EVAPORATION SPECTRA.
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REFERENCES

1) MUGHABGHAB, S.F. ET AL.: NEUTRON CROSS SECTION, VOL.1 (1981).
2) WAGEMANS, C. AND WEIGMAN, H.: GRENOBLE-CONF., 462 (1981).
3) IGARASI, S.: J. NUCL. SCI. TECH., 12, 67 (1975).
4) FU, C.Y.: ATOM.DATA AND NUCL. DATA TABLES, 17, 127 (1976).
5) LEDRER, C.M. ET AL.: TABLE OF ISOTOPES. 7TH EDIT.
6) ASANO ET AL.: PRIVATE COMMUNICATION.
7) YOUNG, P.G. AND ARTHUR, E.D.: LA-6947 (1977).
8) BECCHETI, JR. AND GREENLEES, G.W.: POLARIZATION PHENOMENA
   IN NUCLEAR REACTIONS, P.682 (1971).
9) HUIZENGA, JR. AND IGO, G.J.: NUCL. PHYS., 29, 462 (1962).

MAT number = 1631

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 16-S - 34 FUJI E.C.  EVAL-MAY87 H.NAKAMURA
                      DIST-SEP89 REV2-FEB94
HISTORY
87-05  NEWLY EVALUATED BY H.NAKAMURA (FUJI ELECTRIC CO. LTD.)
94-02  JENDL-3.2
       NEW OPTICAL MODEL CALCULATION WAS PERFORMED BY T. WATANABE
       (KHI).
       DATA WERE COMPILED BY K. SHIBATA (JAERI).
       *****  MODIFIED PARTS FOR JENDL-3.2 *****************
       (3,1),(3,4),(3,51-55),(3,91),(3,251),(4,2),(4,51-55)
              OPTICAL AND STATISTICAL MODEL CALCULATIONS.
       (3,2)   TOTAL - NONELASTIC
       *************************************************

 MF=1   GENERAL INFORMATION
      MT=451  DESCRIPTIVE DATA AND DICTIONARY

 MF=2 MT=151  RESONANCE PARAMETERS:
      RESOLVED RESONANCES FOR MLBW FORMULA: 1.0E-5 EV - 480 KEV
     PARAMETERS ARE TAKEN FROM BNL 325 4TH EDITION/1/, AND
     SOME PARAMETERS ARE ASSUMED TO FIT THE MEASURED DATA.
     CROSS SECTIONS CALCULATED WITH THESE PARAMETERS ARE TO
     BE CORRECTED BY ADDING MF=3, MT=1, 2 AND 102 DATA.
     CALCULATED 2200-M/S CROSS SECTIONS AND RESONANCE INTEGRALS

               2200-M/SEC       RES.INTEG.      REF.
     ELASTIC      2.08 B             -            -
     CAPTURE      0.22 B          0.101  B       /1/
     TOTAL        2.30 B             -            -

 MF=3   NEUTRON CROSS SECTIONS
    BELOW 480KEV
      NO BACKGROUND CROSS SECTION.
      MT=251 MU-BAR=0.0198
    ABOVE 480 KEV.
      MT=1,2,4,51-55,91,102
          TOTAL, ELASTIC, INELASTIC AND CAPTURE CALCULATED WITH
        CASTHY CODE/2/, CONSIDERING THE COMPETITION WITH THE
        THRESHOLD REACTION CHANNELS.
          OPTICAL POTENTIAL PARAMETERS OF C.Y.FU/3/ ARE ADJUSTED
        TO REPRODUCE THE FOLLOWING EXPERIMENTAL DATA:
            MT=1 TOTAL   -
            MT=2 ELASTIC CROSS SECTIONS OF S-32
            MT=4 INELASTIC     -
        THE SPHERICAL OPTICAL POTENTIAL PARAMETERS :
            V = 38.0       VSO= 5.37  (MEV)
            WS= 9.13       WV = 0.0   (MEV)
            R =RSO= 1.26   RS = 1.39  (FM)
            A =ASO= 0.76   B  = 0.40  (FM)
        MT=102 CAPTURE DATA ARE NORMALIZED TO 0.3MB AT 480 KEV
        BASED ON S-32 CAPTURE CROSS SECTION.
          THE DISCRETE LEVEL SCHEME TAKEN FROM  REF./4/:
             NO.       ENERGY(MEV)      SPIN-PARITY
           (G.S.)        0.0               0     +
               1         2.127             2     +
               2         3.304             2     +
               3         3.914             0     +
               4         4.072             1     +
               5         4.115             2     +
        CONTINUUM LEVELS ASSUMED ABOVE 4.5 MEV. THE LEVEL
        DENSITY PARAMETERS OF ASANO ET AL./5/ ARE USED.
     *****  JENDL-3.2 ************************************
     MT=1,4,51-55,91,251
       OPTICAL AND STATISTICAL MODEL CALCULATION
       WAS PERFORMED BY USING THE OMP SET GIVEN AS FOLLOWS:
              V  = 58.83 - 0.5635EN      (MEV)
              WS = 3.609 + 0.1819EN      (MEV)
              VSO= 4.199                 (MEV)
              R  = 1.306,  A  = 0.452     (FM)
              RS = 1.124,  B  = 0.690     (FM)
              RSO= 1.010,  ASO= 0.750     (FM).
     ****************************************************
      MT=16(N,2N), 22(N,N'A), 28(N,N'P), 103(N,P), 107(N,A)
          BASED ON THE STATISTICAL MODEL CALCULATIONS WITH GNASH
        CODE /6/, WITHOUT THE PRECOMPOUND REACTION CORRECTION.
        TRANSMISSION COEFFICIENTS FOR PROTON AND ALPHA PARTICLE
        ARE CALCULATED BY USING THE OMP OF BECCHETTI-GEENLEES/7/
        AND HUIZENGA-IGO/8/, RESPECTIVELY.
          LEVEL DENSITY PARAMETERS ARE BASED ON BUILT-IN VALUES.
      MT=251  MU-BAR
          CALCULATED WITH OPTICAL MODEL (CASTHY) .
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 MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
      MT=2  CALCULATED WITH OPTICAL MODEL (CASTHY).
      MT=51-55  CALCULATED WITH HAUSER-FESHBACH FORMULA (CASTHY)
      MT=16,22,28  ISOTROPIC IN THE LABORATORY SYSTEM.
      MT=91        ISOTROPIC DISTRIBUTIONS IN CM WERE CONVERTED
                   TO THE DISTRIBUTIONS IN LAB.

 MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
      MT=16,22,28,91,103,107  EVAPORATION SPECTRA.
```

REFERENCES

1) MUGHABGHAB, S.F. ET AL.: NEUTRON CROSS SECTION, VOL.1 (1981).
2) IGARASI, S.: JR. NUCL. SCI. TECH., 12, 67 (1975).
3) FU, C.Y.: ATOM. DATA AND NUCL. DATA TABLES., 17, 127 (1976).
4) LEDERER, C.M. ET AL.: TABLE OF ISOTOPES. 7TH EDIT.
5) ASANO ET AL.: PRIVATE COMMUNICATION.
6) YOUNG, P.G. AND ARTHUR, E.D.: LA-6947 (1977).
7) BECCHETI, JR. AND GREENLEES, G.W.: POLARIZATION PHENOMENA IN NUCLEAR REACTIONS, P.682 (1971).
8) HUIZENGA, JR. AND IGO, G.J.: NUCL. PHYS., 29, 462 (1962).

MAT number = 1637

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 16-S - 36 FUJI E.C.  EVAL-MAY87 H.NAKAMURA
                      DIST-SEP89 REV2-FEB94
HISTORY
87-05  NEWLY EVALUATED BY H.NAKAMURA (FUJI ELECTRIC CO. LTD.)
94-02  JENDL-3.2
       NEW OPTICAL MODEL CALCULATION WAS PERFORMED BY T. WATANABE
       (KHI).
       DATA WERE COMPILED BY K. SHIBATA (JAERI).
       *****  MODIFIED PARTS FOR JENDL-3.2 ******************
       (3,1),(3,4),(3,51-55),(3,91),(3,251),(4,2),(4,51-55)
              OPTICAL AND STATISTICAL MODEL CALCULATIONS.
       (3,2)   TOTAL - NONELASTIC
       *****************************************************

 MF=1  GENERAL INFORMATION
      MT=451  DESCRIPTIVE DATA AND DICTIONARY

 MF=2 MT=151 RESONANCE PARAMETERS: (NOT GIVEN)

 MF=3  NEUTRON CROSS SECTIONS
      BELOW 1000 KEV
          ASSUMED CROSS SECTIONS, GUIDED BY THOSE OF S-32
             (10**-5)EV (0.025)EV (1.0**4)EV (1.0**6)EV RES.INT.
        MT=2     2.2 B     2.18 B    2.185 B  2.32339 B      -
        MT=102  3.5 B     0.15 B    0.001 B  0.00015 B  0.12095 B
        MT=1     5.7 B     2.33 B    2.186 B  2.32354 B      -
      ABOVE 1000 KEV
        MT=1,2,4,51-55,91,102
           TOTAL, ELASTIC, INELASTIC AND CAPTURE
         CALCULATED WITH CASTHY CODE /2/, CONSIDERING THE
         COMPETITION WITH THE THRESHOLD REACTION CHANNELS.
           OPTICAL POTENTIAL PARAMETERS OF C.Y.FU/3/ ARE ADJUSTED
         TO REPRODUCE THE FOLLOWING EXPERIMENTAL DATA:
             MT=1  TOTAL -
             MT=2  ELASTIC CROSS SECTIONS OF S-32
             MT=4  INELASTIC -
         THE SPHERICAL OPTICAL POTENTIAL PARAMETERS:
             V = 38.0       VSO= 5.37  (MEV)
             WS= 9.13       WV = 0.0   (MEV)
             R =RSO= 1.26  RS = 1.39  (FM)
             A =ASO= 0.76  B  = 0.40  (FM)
           MT=102 CAPTURE DATA ARE NORMALIZED TO 0.15 MB AT 1 MEV
         BASED ON S-32 CAPTURE CROSS SECTION.
           THE DISCRETE LEVEL SCHEME TAKEN FROM REF./4/:
             NO.      ENERGY (MEV)      SPIN-PARITY
           (G.S.)       0.0              0   +
               1        3.291            2   +
               2        3.346            0   +
               3        4.192            3   -
               4        4.523            1   +
               5        4.575            2   +
         CONTINUUM LEVELS ASSUMED ABOVE 5.0 MEV. THE LEVEL
         DENSITY PARAMETERS OF ASANO ET AL./5/ ARE USED.
     *****  JENDL-3.2 ***********************************
     MT=1,4,51-55,91,251
       OPTICAL AND STATISTICAL MODEL CALCULATION
       WAS PERFORMED BY USING THE OMP SET GIVEN AS FOLLOWS:
               V  = 58.83 - 0.5635EN      (MEV)
               WS = 3.609 + 0.1819EN      (MEV)
               VSO= 4.199                 (MEV)
               R  = 1.306,  A  = 0.452     (FM)
               RS = 1.124,  B  = 0.690     (FM)
               RSO= 1.010,  ASO= 0.750     (FM).
     ***************************************************
        MT=16(N,2N), 22(N,N'A), 28(N,N'P), 103(N,P), 107(N,A)
           BASED ON THE STATISTICAL MODEL CALCULATIONS WITH GNASH
         CODE /6/, WITHOUT THE PRECOMPOUND REACTION CORRECTION.
         TRANSMISSION COEFFICIENTS FOR PROTON AND ALPHA PARTICLE
         ARE CALCULATED BY USING THE OMP OF BECCHETTI-GEENLEES
         /7/ AND HUIZENGA-IGO/8/,RESPECTIVELY.
           LEVEL DENSITY PARAMETERS ARE BASED ON BUILT-IN VALUES.
        MT=251  MU-BAR
           CALCULATED WITH OPTICAL MODEL (CASTHY).

 MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
      MT=2  CALCULATED WITH OPTICAL MODEL (CASTHY).
      MT=51-55  CALCULATED WITH HAUSER-FESHBACH FORMULA(CASTHY)
      MT=16,22,28  ISOTROPIC IN THE LABORATORY SYSTEM.
      MT=91        ISOTROPIC DISTRIBUTIONS IN CM WERE CONVERTED
                   TO THE DISTRIBUTIONS IN LAB.
```

MF=5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=16,22,28,91,103,107 EVAPORATION SPECTRA.

REFERENCES

1) MUGHABGHAB, S.F. ET AL.: NEUTRON CROSS SECTION, VOL.1 (1981).
2) IGARASI, S.: J. NUCL. SCI. TECH., 12, 67 (1975).
3) FU, C.Y.: ATOM. DATA AND NUCL. DATA TABLES., 17, 127 (1976).
4) LEDERER, C.M. ET AL.: TABLE OF ISOTOPES. 7TH EDIT.
5) ASANO ET AL.: PRIVATE COMMUNICATION.
6) YOUNG, P.G. AND ARTHUR, E.D.: LA-6947 (1977).
7) BECCHETI, JR. AND GREENLEES, G.W.: POLARIZATION PHENOMENA IN NUCLEAR REACTIONS, P.682 (1971).
8) HUIZENGA, JR. AND IGO, G.J.: NUCL. PHYS., 29, 462 (1962).

MAT number = 1700

17-CL-0 KHI EVAL-MAR94 T.WATANABE
DIST-APR94

HISTORY
94-3 NEW EVALUATION CONSTRUCTED FROM ISOTOPE DATA

MF=1 GENERAL INFORMATION
MT=451 COMMENTS AND DICTIONARY

MF=2 RESONANCE PARAMETERS
MT=151 RESOLVED RESONANCE PARAMETERS
RESOLVED RESONANCE PARAMETERS FOR MLBW FORMULA.(BELOW 226.0 KEV)
BELOW 226 KEV BACKGROUND CROSS SECTION WAS ALSO GIVEN.
BETWEEN 202 TO 226 KEV: CL-37 SMOOTH CROSS SECTION WERE ADDED AS A BACKGROUND CROSS SECTION. BELOW 226KEV CL-35(N,P),(N,A) CROSS SECTION WAS ADDED ALSO BACKGROUND CROSS SECTION.
THE DATA WERE CONSTRUCTED FROM THE EVALUATED CROSS SECTIONS FOR CL-35 AND CL-37, CONSIDERING THEIR ABUNDANCES/1/.

CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)

	2200 M/S	RES. INTEG.
TOTAL	49.03	-
ELASTIC	15.89	-
CAPTURE	33.14	13.57

MF=3 NEUTRON CROSS SECTIONS
BELOW 226 KEV, RESONANCE PARAMETERS WERE GIVEN.
ALSO BACKGROUND CROSS SECTIONS WERE GIVEN TO TOTAL,ELASTIC, CAPTURE,(N,P) AND (N,A) PARTIAL CROSS SECTIONS.
ABOVE 202 KEV, THE TOTAL, ELASTIC AND INELASTIC SCATTERING, AND CAPTURE CROSS SECTIONS WERE CALCULATED WITH THE OPTICAL AND STATISTICAL MODEL CODE CASTHY/2/. OPTICAL POTENTIAL PARAMETERS USED WERE AS FOLLOWS.

DEPTH (MEV)	R*A**(1/3)	DIFFUSENESS(FM)
V = 46.68-0.3459E	, R0 = 1.450	, A0 = 0.308
WS = 3.584+1.224E	, RS = 1.433	, AS = 0.338
WSO= 6.2	, RSO= 1.200	, ASO= 0.638

THE LEVEL SCHEME WAS ADOPTED FROM ENSDF FILE FOR EACH ISOTOPES.

NO.	ENERGY(MEV)	SPIN-PARITY	ISOTOPES
GR.	0.0	3/2 +	CL-35,CL-37
1	1.2193	1/2 +	CL-35
2	1.7266	1/2 +	CL-37
3	1.7632	5/2 +	CL-35
4	2.6453	7/2 +	CL-35
5	2.6936	3/2 +	CL-35
6	3.0026	5/2 +	CL-35
7	3.0866	5/2 +	CL-37
8	3.1033	7/2 -	CL-37
9	3.1626	7/2 -	CL-35
10	3.6260	3/2 +	CL-37
11	3.7078	3/2 +	CL-37
12	3.7409	5/2 -	CL-37
13	3.9184	3/2 +	CL-35
14	3.9432	9/2 +	CL-35
15	3.9675	1/2 +	CL-35
16	4.0099	9/2 -	CL-37
17	4.0163	3/2 +	CL-37
18	4.0592	3/2 -	CL-35
19	4.1133	7/2 +	CL-35
20	4.1734	5/2 -	CL-35
	4.1779	3/2 -	CL-35
	4.1766	3/2 -	CL-37
21	4.2689	1/2 +	CL-37
	4.2726	7/2 -	CL-37
22	4.3473	9/2 -	CL-35
	4.3963	5/2 +	CL-37
23	4.4600	7/2 -	CL-37
24	4.5460	11/2 -	CL-37
25	4.6242	3/2 +	CL-35
26	4.7679	7/2 -	CL-35
	4.7700	13/2 +	CL-37
27	4.8012	5/2 +	CL-37
28	4.8109	7/2 +	CL-37
29	4.8406	1/2 +	CL-35
	4.8376	5/2 +	CL-37
30	4.8544	1/2 +	CL-35
	4.8540	1/2 -	CL-37
31	4.8817	7/2 +	CL-35
32	4.9042	7/2 +	CL-37

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        33        4.9210        9/2 -          CL-37
                  4.9230       13/2 +          CL-37
        34        4.9608        3/2 +          CL-37
        35        4.9740       13/2 +          CL-37
        36        5.0104        1/2 -          CL-35
                  5.0093        5/2 +          CL-37
        37        5.0552        5/2 +          CL-37
                  5.0591        3/2 -          CL-37
     LEVELS ABOVE 5.02MEV WERE ASSUMED TO BE OVERLAPPING.

  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GIRBERT-
  CAMERON WERE EVALUATED.
  SPIN CUT-OFF PARAMETER C1 WAS TAKEN AS 0.146.

                           CL- 35    CL- 36    CL- 37    CL-38
                         ----------------------------------------
  A (MEV)                  5.205     5.434     5.564     6.299
  SPIN CUT-OFF PARAM.      3.564     3.711     3.824     4.142
  PAIRING ENERGY (MEV)     1.860     0.0       2.040     0.0
  NORMALIZATION FACTOR   344.94    370.41    389.80    453.22
  E-JOINT (MEV)            7.542     3.561     7.099     3.313

  MT=16,22,28,32,102,103,104,105,106,107,111,251
     (N,2N),(N,NA),(N,NP),(N,ND),(N,P),(N,D),(N,T),(N,HE-3),
     (N,A),(N,2P),MU-BAR
  WERE CONSTRUCTED FROM EACH CL ISOTOPE DATA CONSIDERING
  ABUNDANCES.
  CROSS SECTIONS FOR EACH ISOTOPE WERE EVALUATED USING CASTHY/2/
  AND MODIFIED EGNASH-2/3/ PROGRAMM.

MF=4  MT=2,16,22,28,32,51-87,91
  (N,2N),(N,NA),(N,NP),(N,ND) AND ELASTIC AND INELASTIC SCATTERING
  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  WERE CONSTRUCTED FROM EACH CL ISOTOPE DATA CONSIDERING
  ABUNDANCES.

MF=5  MT=16,22,28,32,91
  (N,2N),(N,NA),(N,NP),(N,ND) AND CONTINUM INELSTIC SCATTERING
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  WERE CONSTRUCTED FROM EACH CL ISOTOPE DATA CONSIDERING
  ABUNDANCES.
```

REFERENCES


```
 1)C.M.LEDERER ET.AL.      TABLE OF ISOTOPES 7TH ED.(1978)
                           JOHN WILEY & SONS INC.
 2)S.IGARASHI,T.FUKAHORI   JAERI-1321     (1991)
 3)N.YAMAMURO              JAERI-M 90-006(1991)
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MAT number = 1725

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 17-CL- 35 KHI          EVAL-MAR94 T.WATANABE
                        DIST-APR94
HISTORY
94-3  NEWLY EVALUATED

MF=1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF=2  RESONANCE PARAMETERS
  MT=151 RESOLVED RESONANCE PARAMETERS(BELOW 226KEV)
  RESOLVED RESONANCE PARAMETERS FOR MLBW FORMULA.
  NEGATIVE ENERGY LEVEL PARAMETERS WERE ADJUSTED TO REPRODUCE
  2200M/S CROSS SECTIONS.
  EVALUATION WAS MAINLY BASED ON MACKLINS/1/ DATA AND
  MUGHABGHABS/2/ COMPILATION.
  BELOW 226KEV,(N,P) AND (N,A) CROSS SECTIONS WERE GIVEN AS
  BACKGROUND TOTAL CROSS SECTION.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                   2200 M/S               RES. INTEG.
      TOTAL        64.2                     -
      ELASTIC      20.6                     -
      CAPTURE      43.6                   17.8

MF=3  NEUTRON CROSS SECTIONS
  BELOW 226 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 226 KEV, THE TOTAL, ELASTIC AND INELASTIC SCATTERING, AND
  CAPTURE CROSS SECTIONS WERE CALCULATED WITH THE OPTICAL AND
  STATISTICAL MODEL CODE CASTHY/4/.
  ABOVE 1.0MEV, DIRECT/SEMIDIRECT CAPTURE NORMALIZED TO 0.349MB AT
  14MEV WERE ADDED TO CASTHYS RESULTS/5/.
  OPTICAL MODEL PARAMETERS USED IN CASTHY CALCULATION WERE SHOWN
  AS FOLLOWS.

              DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
       ----------------------  ------------  ---------------
     V  = 46.68-0.3459E       , R0 =  4.743      , A0 =  0.308
     WI =-0.0007E**2          , RI =  0.0        , AI =  0.0
     WS = 3.584+1.224E        , RS =  4.6874     , AS =  0.338
     WSO= 6.2                 , RSO=  3.9253     , ASO=  0.638

  THE LEVEL SCHEME WAS ADOPTED FROM ENSDF FILE/6/.
           NO.      ENERGY(MEV)    SPIN-PARITY    BETA2/BETA3
           GR.        0.0            3/2 +
            1         1.2193         1/2 +          0.28
            2         1.7632         5/2 +          0.15
            3         2.6453         7/2 +          0.2
            4         2.6936         3/2 +          0.25
            5         3.0026         5/2 +          0.2
            6         3.1626         7/2 -          0.25
            7         3.9185         3/2 +          0.2
            8         3.9432         9/2 +          0.2
            9         3.9675         1/2 +          0.15
           10         4.0592         3/2 -          0.25
           11         4.1133         7/2 +          0.15
           12         4.1734         5/2 -          0.2
           13         4.1779         3/2 -          0.2
           14         4.3473         9/2 -
           15         4.6242         3/2 +
           16         4.7679         7/2 -
           17         4.8406         1/2 +
           18         4.8544         1/2 +
           19         4.8817         7/2 +
           20         5.0104         1/2 -
      LEVELS ABOVE 5.02MEV WERE ASSUMED TO BE OVERLAPPING.

  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GIRBERT-
  CAMERON WERE EVALUATED.
  SPIN CUT-OFF PARAMETER C1 WAS TAKEN AS 0.146.

                                   CL- 35      CL- 36
                                  --------    --------
        A (MEV)                     5.205       5.434
        SPIN CUT-OFF PARAM.         3.564       3.711
        PAIRING ENERGY (MEV)        1.860       0.0
        NORMALIZATION FACTOR      344.94      370.41
        E-JOINT (MEV)               7.542       3.561

  THE CAPTURE CROSS SECTION WAS NORMALIZED TO 3 MILLIBARNS AT
  100 KEV.
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  MT=16,22,28,32,103,104,105,106,107,111
     (N,2N),(N,NA),(N,NP),(N,ND),(N,P),(N,D),(N,T),(N,HE-3),
     (N,A),(N,2P)
  THESE CROSS SECTIONS WERE EVALUATED
  WITH MODIFIED EGNASH-2/7/ USING F2=0.5 AND
  FOLLOWING OPTICAL POTENTIAL
     NEUTRON    :SAME AS USED IN CASTHY
     PROTON     :PEREYS OMP/8/
     DEUTRON    :PEREY-PEREYS OMP/9/
     TRITON     :RAGAINIS OMP/10/
     HE-3       :LUETZESHWABS OMP/11/
     ALPHA      :BOCKS OMP/12/
  AND NORMALIZED TO FOLLOWING DATA.
     (N,2N)        9.6   MB     AV. EXP. DATA/13,14/
     (N,P)       125.0   MB     AV. EXP. DATA/16,17/
     (N,D)        12.6   MB     SYSTEMATICS/15/
     (N,A)       117.0   MB     AV. EXP. DATA/18/

  BELOW 58.607KEV, (N,P) CROSS SECTION WAS CALCULATED USING
  KOEHLERS RESONANCE PARAMETERS/3/. ENERGY DEPENDENCE OF LOW
  ENERGY (N,A) CROSS SECTION WAS ASSUMED AS 1/V AND NORMALIZED
  TO 0.08MB AT 2200 M/S./2/

  THE MU-BAR(MT=251) WAS ALSO CALCULATED WITH CASTHY.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,16,22,28,32,51-70,91
  ELASTIC AND INELASTIC SCATTERING CROSS SECTION,(N,2N),(N,NA),
  (N,NP),(N,ND)
  ANGULAR DISTRIBUTIONS WERE CALCULATED WITH CASTHY FOR ELA-
  STICALLY AND INELASTICALLY SCATTERED NEUTRONS. THE DIRECT
  INELASTIC SCATTERING CONTRIBUTION WAS EVALUATED WITH DWUCKY/19/.
  DEFORMATION PARAMETERS USED IN DWUCKY CALCULATION WERE EVALUTED
  FROM COMPILAITON/20,21/, AND ENSDF HALF LIFE DATA.
  AS FOR (N,2N),(N,NA),(N,NP),(N,ND) ISOTROPIC DISTRIBUTIONS WERE
  ASSUMED.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,22,28,32,91
  FOR (N,2N),(N,NA),(N,NP),(N,ND) AND CONTINUM INELASTIC
  SCATTERING CROSS SECTIONS, SECONDARY NEUTRON ENERGY DISTRIBUTION
  WERE CALCULATED WITH EGNASH-2.
```

REFERENCES


```
 1)R.L.MACKLIN  ET. AT.,   PR    C29,1996(1984)
 2)S.F.MUGHABGHAB ET. AL., NEUTRON CROSS SECTION VOL.1 PART A
                           ACADEMIC PRESS(1981)
 3)P.E.KOEHLER             PR/C44,1675(1991)
 4)S.IGARASHI,T.FUKAHORI   JAERI-1321     (1991)
 5)T.NAKAGAWA              CAPDIR  MANUAL
 6)EVALUATED NUCLEAR STRUCTURAL DATA FILE
 7)N.YAMAMURO              JAERI-M 90-006(1991)
 8)F.G.PEREY               PR    131, 745(1963)
 9)C.M.PEREY,F.G.PEREY     PR    132, 752(1963)
10)R.C.RAGAINI ET. AL.     PR     C2,1020(1970)
11)J.W.LUETZELSCFWAB ET.AL PR    180,1023(1964)
12)R.BOCK ET. AL.          NP    A92, 539(1967)
13)Y.IKEDA ET AL.          JAERI-1312(1988)
14)G.PETO                  AHP,24,93(1968)
15)R.A.FORREST             AERE-R 12419(1986)
16)D.L.ALLAN               NP 24,274(1961)
17)W.SCANTL                SCANTL
18)W.NAGEL                 NAGEL
19)N.YAMAMURO              JAERI-M 88-140(1988)
20)S.RAMAN ET.AL.          AND 42,1(1989)
21)R.H.SPEAR               AND 42,55(1989)
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MAT number = 1731

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 17-CL- 37 KHI        EVAL-MAR94 T.WATANABE
                      DIST-APR94
HISTORY
94-3  NEWLY EVALUATED

MF=1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF=2  RESONANCE PARAMETERS(BELOW 202.0KEV)
  MT=151 RESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE PARAMETERS FOR MLBW FORMULA WITH VARING SCAT-
  ERING RADIUS. NEGATIVE ENERGY LEVEL DATA WERE ADJUSTED TO
  REPRODUCE 2200M/S CROSS SECTIONS.
  EVALUATION WAS MAINLY BASED ON MACKLINS/1/ DATA AND
  MUGHABGHABS/2/ COMPILATION.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           1.583                     -
      ELASTIC         1.15                      -
      CAPTURE         0.433                   0.204

MF=3  NEUTRON CROSS SECTIONS
  BELOW 202 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 202 KEV, THE TOTAL, ELASTIC AND INELASTIC SCATTERING, AND
  CAPTURE CROSS SECTIONS WERE CALCULATED WITH THE OPTICAL AND
  STATISTICAL MODEL CODE CASTHY/3/.
  DIRECT/SEMIDIRECT CROSS SECTION WERE NORMALIZED TO 0.286MB AT
  14 MEV, WERE CORRECTED TO CASTHY'S RESULTS/4/.
  OPTICAL MODEL PARAMETERS USED IN CASTHY CALCULATION WERE AS
  FOLLOWS.

               DEPTH (MEV)         RADIUS(FM)    DIFFUSENESS(FM)
         ----------------------   ------------   ---------------
     V  = 46.68-0.3459E          , R0 =  4.8317     , A0 =  0.308
     WS = 3.584+1.224E           , RS =  4.7751     , AS =  0.338
     WSO= 6.2                    , RSO=  3.9987     , ASO=  0.638

  THE LEVEL SCHEME WAS ADOPTED FROM ENSDF FILE/5/.
           NO.      ENERGY(MEV)    SPIN-PARITY   BETA2/BETA3
           GR.      0.0             3/2 +
            1       1.7266          1/2 +         0.2
            2       3.0866          5/2 +         0.2
            3       3.1033          7/2 -         0.25
            4       3.6260          3/2 +         0.15
            5       3.7078          3/2 +         0.15
            6       3.7409          5/2 -         0.25
            7       4.0099          9/2 -         0.2
            8       4.0163          3/2 +         0.15
            9       4.1766          3/2 -         0.2
           10       4.2689          1/2 +         0.15
           11       4.2726          7/2 -         0.2
           12       4.3963          5/2 +         0.1
           13       4.4600          7/2 -
           14       4.5460         11/2 -
           15       4.7700         13/2 +
           16       4.8012          5/2 +
           17       4.8109          7/2 +
           18       4.8376          5/2 +
           19       4.8540          1/2 -
           20       4.9042          7/2 +
           21       4.9210          9/2 -
           22       4.9230         13/2 +
           23       4.9608          3/2 +
           24       4.9740         13/2 +
           25       5.0093          5/2 +
           26       5.0552          5/2 +
           27       5.0591          3/2 -
      LEVELS ABOVE 5.06 MEV WERE ASSUMED TO BE OVERLAPPING.

  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GIRBERT-
  CAMERON WERE EVALUATED.
  SPIN CUT-OFF PARAMETER C1 WAS TAKEN AS 0.146.

                                    CL- 37      CL- 38
                                   --------    --------
          A (MEV)                    5.564       6.299
          SPIN CUT-OFF PARAM.        3.824       4.142
          PAIRING ENERGY (MEV)       2.040       0.0
          NORMALIZATION FACTOR     389.80      453.22
          E-JOINT (MEV)              7.099       3.313
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  THE CAPTURE CROSS SECTION WAS ADJUSTED TO DOVBENKOS DATA/6/.

  MT=16,22,28,32,33,103,104,105,106,107
     (N,2N),(N,NA),(N,NP),(N,ND),(N,NT),(N,P),(N,D),(N,T),
     (N,HE-3),(N,A)
  WERE EVALUATED WITH MODIFIED EGNASH-2/7/ USING F2=0.5 AND
  FOLLOWING OPTICAL POTENTIAL
     NEUTRON    :SAME AS USED IN CASTHY
     PROTON     :PEREYS OMP/8/
     DEUTRON    :PEREY-PEREYS OMP/9/
     TRITON     :RAGAINIS OMP/10/
     HE-3       :LUETZESHWABS OMP/11/
     ALPHA      :BOCKS OMP/12/
  AND NORMALIZED TO FOLLOWING DATA.
     (N,NA)       3.93    MB       SYSTEMATICS/13/
     (N,P)       22.3     MB       KAWADES DATA/14/
     (N,D)        8.18    MB       SYSTEMATICS
     (N,T)        0.84    MB       SYSTEMATICS
     (N,A)       31.5     MB       AV. EXP. DATA/15,16,17/

  THE MU-BAR(MT=251) WAS ALSO CALCULATED WITH CASTHY.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,16,22,28,32,51-77,91
  ELASTIC AND INELASTIC SCATTERING CROSS SECTION,(N,2N),(N,NA),
  (N,NP) AND (N,ND)
  ANGULAR DISTRIBUTIONS WERE CALCULATED WITH CASTHY FOR ELA-
  STICALLY AND INELASTICALLY SCATTERED NEUTRONS.
  DIRECT INELASTIC CONTRIBUTION WERE CALCULATED WITH DWUCKY/18/.
  DEFORMATION PARAMETERS USED IN DWUCKY CALCULATION WERE
  EVALUATED FROM COMPILATIONS/19,20/ AND ENSDF HALF LIFE DATA.
  AS FOR (N,2N),(N,NA),(N,NP) AND (N,ND) ISOTROPIC DISTRIBUTIONS
  WERE ASSUMED.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,22,28,32,91
  FOR (N,2N),(N,NA),(N,NP),(N,ND) AND CONTINUM INELASTIC
  SCATTERING CROSS SECTIONS, SECONDARY NEUTRON ENERGY DISTRIBUTIO
  WERE CALCULATED WITH EGANSH-2.
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15)R.PRASAD                NP 85,476(1966)
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20)R.H.SPEAR               AND 42,55(1989)
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MAT number = 1837
 18-AR- 40 KHI          EVAL-MAR94 T.WATANABE
                        DIST-APR94
HISTORY
94-3  NEWLY EVALUATED

MF=1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF=2  RESONANCE PARAMETERS
  MT=151 RESOLVED RESONANCE PARAMETERS(BELOW 1.49774MEV)
  REICH-MOORE FORMULA WAS ADOPTED. ABOVE 100KEV,BACKGROUND CROSS
  SECTION WAS GIVEN TO REPRODUCE WINTERS MEASUREMENT/1/.
  NEGATIVE ENERGY LEVEL PARAMETERS WERE ADJUSTED TO REPRODUCE
  2200M/S CROSS SECTIONS.
  EVALUATION WAS MAINLY BASED ON WINTERS/1/, MACKLINS/2/ DATA
  AND MUGHABGHABS/3/ COMPILATION.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           1.307                     -
      ELASTIC         0.647                     -
      CAPTURE         0.66                    0.294

MF=3  NEUTRON CROSS SECTIONS
  BELOW 1.49774 MEV, RESONANCE PARAMETERS WERE GIVEN.
  BELOW 5.0MEV, WINTERS TOTAL CROSS SECTION MEASUREMENT/1/ WAS
  FOLLOWED. ELASTIC SCATTERING CROSS SECTION WAS RECONSTRUCTED
  FROM DIFFERENCE BETWEEN TOTAL AND SUM OF OTHER PARTIAL CROSS
  SECTIONS.
  ABOVE 1.5 MEV, INELASTIC SCATTERING AND CAPTURE CROSS SECTION
  AND ABOVE 5.0 MEV, TOTAL AND ELASTIC SCATTERING CROSS SECTION
  WERE CALCULATED WITH THE OPTICAL AND STATISTICAL MODEL CODE
  CASTHY/4/.
  DIRECT PROCESS FOR INELASTIC SCATTERING WERE CORRECTED WITH
  DWBA CODE DWUCKY/5/. THE PARAMETERS USED IN DWUCKY CALCULATION
  WERE ESTIMATED FROM RAMANS/6/ COMPILATION AND HALF LIFE DATA OF
  ENSDF FILE/7/.
  OPTICAL MODEL PARAMETERS USED IN CASTHY CALCULATION WERE AS
  FOLLOWS.

               DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
         ----------------------  ------------  ---------------
     V  = 53.39-0.2233E        , R0 =  4.4494     , A0 =  0.536
     WS = 3.365+2.445E         , RS =  3.7448     , AS =  0.419
     WSO= 4.705                , RSO=  4.8085     , ASO=  0.6

  THE LEVEL SCHEME WAS ADOPTED FROM ENSDF FILE.
           NO.      ENERGY(MEV)    SPIN-PARITY      BETA 2/3
           GR.       0.0000          0  +
            1        1.4609          2  +           0.25
            2        2.1208          0  +
            3        2.5241          2  +           0.15
            4        2.8930          4  +
            5        3.2083          2  +           0.2
            6        3.4645          6  +
            7        3.5113          1  +
            8        3.5150          4  +
            9        3.6810          3  -           0.25
           10        3.9188          2  +           0.15
           11        3.9420          1  +
           12        4.0420          0  +
           13        4.0829          3  -           0.2
           14        4.1790          1  +
           15        4.2260          4  -
           16        4.2290          4  +
           17        4.3012          1  -
           18        4.3245          2  +           0.15
           19        4.3580          1  -
           20        4.4190          3  -           0.15
           21        4.4270          3  +
           22        4.4810          1  +
           23        4.4941          5  -
           24        4.5621          1  -
           25        4.5780          2  +
      LEVELS ABOVE 4.58 MEV WERE ASSUMED TO BE OVERLAPPING.

  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GIRBERT-
  CAMERON WERE ADOPTED.
  SPIN CUT-OFF PARAMETER C1 WAS TAKEN AS 0.146.
                                   AR- 40      AR- 41
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          A (MEV)                     8.301        8.443
          SPIN CUT-OFF PARAM.         4.920        5.044
          PAIRING ENERGY (MEV)        3.260        1.620
          NORMALIZATION FACTOR      628.70       655.44
          E-JOINT (MEV)               9.363        6.164

  THE CAPTURE CROSS SECTION WAS NORMALIZED TO REPRODUCE 1.35
  MILLIBARN AT 300 KEV/2/. ABOVE 1 MEV, DIRECT/SEMIDIRECT CAPTURE
  CROSS SECTION NORMALIZED TO 0.523 MB AT 14.5 MEV WERE ADDED TO
  ABOVE CASTHY'S RESULTS/8/.

  MT=16,17,22,28,103,104,105,106,107
     (N,2N),(N,3N),(N,NA),(N,NP),(N,P),(N,D),(N,T),(N,HE-3),
     (N,A)
  WERE EVALUATED WITH MODIFIED EGNASH-2/9/ USING F2=1.4 AND
  FOLLOWING OPTICAL POTENTIALS.
     NEUTRON    :SAME AS USED IN CASTHY
     PROTON     :PEREYS OMP/10/
     DEUTRON    :PEREY-PEREYS OMP/11/
     TRITON     :RAGAINIS OMP/12/
     HE-3       :LUETZESHWABS OMP/13/
     ALPHA      :BOCKS OMP/14/
  AND NORMALIZED TO FOLLOWING VALUES AT 14.5 MEV.
     (N,NA)     2.17  MB         SYSTEMATICS/15/
     (N,NP)     0.06  MB         SYSTEMATICS
     (N,P)     16.0   MB         RANAKUMARS DATA/16/
     (N,D)      2.9   MB         GRAYS DATA/17/
     (N,A)     10.0   MB         AV. OF EXP. DATA/16,18,19/

  THE MU-BAR(MT=251) WAS ALSO CALCULATED WITH CASTHY.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,16,17,22,28,51-75,91
  ELASTIC AND INELASTIC SCATTERING,(N,2N),(N,3N),(N,NA),(N,NP)
  ANGULAR DISTRIBUTIONS WERE CALCULATED WITH CASTHY FOR ELA-
  STICALLY AND INELASTICALLY SCATTERED NEUTRONS.  THE DIRECT
  INELASTIC SCATTERING CONTRIBUTION WAS EVALUATED WITH DWUCKY
  PROGRAMM.
  AS FOR (N,2N),(N,3N),(N,NA) AND (N,NP),ISOTROPIC DISTRIBUTION
  WAS ASSUMED.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,22,28,91
  FOR (N,2N),(N,3N),(N,NA),(N,NP) AND CONTINUM INELASTIC SCATTER-
  ING,SECONDARY NEUTRON ENERGY DISTRIBUTION WAS CALCULATED WITH
  EGNASH-2.

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```
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 8)T.NAKAGAWA               CAPDIR MANUAL
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10)F.G.PEREY                PR    131, 745(1963)
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MAT number = 1900

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 19-K -  0 FUJI E.C.  EVAL-MAY87 H.NAKAMURA
                      DIST-SEP89 REV2-FEB94
HISTORY
87-05  NEWLY EVALUATED BY H.NAKAMURA (FUJI ELECTRIC CO. LTD.)
87-07  COMPILED BY T.FUKAHORI (JAERI).
94-02  JENDL-3.2
       TOTAL CROSS SECTION WAS CALCULATED BY T. WATANABE (KHI).
       INELASTIC SCATTERING CROSS SECTIONS WERE CALCULATED BY
       K.SHIBATA (JAERI).
       GAMMA PRODUCTION DATA WERE EVALUATED BY T. ASAMI (DE).
       DATA WERE COMPILED BY K.SHIBATA.
*****  MODIFIED PARTS FOR JENDL-3.2 ***************************
(3,1),(3,4),(3,51-91),(3,251),(4,2),(4,51-61)
               NEW OPTICAL AND STATISTICAL MODEL CAL.
(3,2)          TOTAL - NONELASTIC
(5,16-91)      SUBSECTIONS WERE COMBINED.
MF=12,13,14,15 NEWLY EVALUATED.
**************************************************************

 NATURAL POTASSIUM CONSTRUCTED FROM ITS ISOTOPES.

MF=1  GENERAL INFORMATION
     MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
     MT=151  RESOLVED RESONANCES
        RESONANCE REGION : 1.0E-5 EV - 200 KEV
       THE MULTILEVEL BREIT-WIGNER FORMULA WAS USED. PARAMETERS
       WERE ADOPTED FROM THE FOLLOWING SOURCES.
          K-39 : -4.0 - 200 KEV, R = 1.80 FM
          K-41 : -6.6 - 125 KEV, R = 2.00 FM

       CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS.
                      2200-M/S      RES. INTEG.
          ELASTIC      2.096  B          -
          CAPTURE      2.058  B        1.118 B
          TOTAL        4.159  B          -

MF=3  NEUTRON CROSS SECTIONS
        BELOW 200 KEV, BACKGROUND CROSS SECTIONS CONSISTED OF
       ELASTIC, CAPTURE, (N,P) AND (N,ALPHA) CROSS SECTIONS
       WERE GIVEN.

     MT=1  TOTAL
        FOR ENERGIES 0.2 - 20 MEV, THE WEIGHTED SUM OF ISOTOPES
       DATA WERE TAKEN. THE ISOTOPIC CALCULATIONS WERE PERFORMED
       BY USING CASTHY CODE/1/.
     MT=2  ELASTIC SCATTERING
        GIVEN AS TOTAL MINUS OTHER CROSS SECTIONS.
     MT=4  TOTAL INELASTIC SCATTERING
        SUM OF MT=51-61, 91
     MT=16,22,28,103,107
        THE WEIGHTED SUM OF ISOTOPES WAS ADOPTED. THE CROSS
       SECTIONS OF ISOTOPES WERE CALCULATED USING GNASH CODE/2/.
     MT=51-61,91  INELASTIC SCATTERING
        ISOTOPIC DATA WERE OBTAINED FROM THE CASTHY/1/
       CALCULATION. ISOTOPIC LEVELS WERE SORTED WITH ENERGIES.

       OPTICAL POTENTIAL PARAMETERS USED IN THE CALCULATION ARE
       AS FOLLOWS:
            V  = 46.72,     R0 = 1.26, A0 = 0.76
            WS =  9.13,     RS = 1.39, AS = 0.40
            VSO=  5.37,     RSO= 1.26, ASO= 0.76
              ENERGIES IN MEV UNIT, LENGTHS IN FM UNIT.
     *****  JENDL-3.2 ***************************************
     THE CROSS SECTIONS WERE CALCULATED BY USING THE OMP SET
     DETERMINED BY T. WATANABE.
            V = 54.36 - 0.325EN        (MEV)
            WS= 2.258 + 0.1698EN       (MEV)
            VSO=3.341                  (MEV)
            R  = 1.200   , A  = 0.658  (FM)
            RS = 1.320   , B  = 0.602  (FM)
            RSO= 1.100   , ASO= 0.406  (FM)
     ********************************************************

     MT=102  CAPTURE
        ABOVE 200 KEV, THE CASTHY/1/ CALCULATION WAS ADOPTED.
     MT=103(N,P), 107(N,ALPHA)
        ABOVE 200 KEV, BASED ON CALCULATIONS USING THE GNASH/2/
       CODE.
     MT=251  MU-BAR
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        CALCULATED WITH CASTHY/1/.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
     MT=2,51-61
        OPTICAL AND STATISTICAL-MODEL CALCULATIONS.
     MT=16,22,28
        ASSUMED TO BE ISOTROPIC IN THE LABORATORY SYSTEM.
     MT=91
        ISOTROPIC DISTRIBUTIONS IN C.M. WERE CONVERTED TO THE
        DISTRIBUTIONS IN LAB.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
     MT=16,22,28,91
        CALCULATED WITH GNASH/2/.

MF=12 PHOTON PRODUCTION MULTIPLICITY
     MT=102,103,107
        CALCULATED WITH SINCROS-II/3/.

MF=13 PHOTON PRODUCTION CROSS SECTION
     MT=3
        CALCULATED WITH SINCROS-II/3/.
     MT=4
        GENERATED BY TAKING ACCOUNT OF BRANCHING RATIOS.

MF=14 PHTON ANGULAR DISTRIBUTION
     MT=3,4,102,103,107
        ASSUMED TO BE ISOTROPIC.

MF=15 PHOTON ENERGY DISTRIBUTION
     MT=3,4,103,107
        CALCULATED WITH SINCROS-II/3/.
     MT=102
        CALCULATED WITH CASTHY/1/.
```

REFERENCES

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2) YOUNG, P.G. AND ARTHUR, E.D.: LA-6947 (1977).
3) YAMAMURO, N: JAERI-M 90-006 (1990).

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MAT number = 1925
 19-K - 39 FUJI E.C.  EVAL-MAY87 H.NAKAMURA
                      DIST-SEP89 REV2-FEB94
HISTORY
87-05  NEWLY EVALUATED BY H.NAKAMURA (FUJI ELECTRIC CO. LTD.)
94-02  JENDL-3.2
       TOTAL CROSS SECTION WAS CALCULATED BY T. WATANABE (KHI).
       INELASTIC SCATTERING CROSS SECTIONS WERE CALCULATED BY
       K.SHIBATA (JAERI).
       DATA WERE COMPILED BY K.SHIBATA.
*****  MODIFIED PARTS FOR JENDL-3.2 ****************************
(3,1),(3,4),(3,51-91),(3,251),(4,2),(4,51-54)
              NEW OPTICAL AND STATISTICAL MODEL CAL.
(3,2)         TOTAL - NONELASTIC
***************************************************************
MF=1  GENERAL INFORMATION
     MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2 MT=151  RESONANCE PARAMETERS:
        RESOLVED RESONANCES FOR MLBW FORMULA: 1.0E-5 EV - 200 KEV
      PARAMETERS ARE TAKEN FROM BNL 325 4TH EDITION/1/, AND
      SOME PARAMETERS ARE ASSUMED TO FIT THE MEASURED DATA.
      CROSS SECTIONS CALCULATED WITH THESE PARAMETERS ARE TO
      BE CORRECTED BY ADDING MF=3, MT=1, 2 AND 102 DATA.
      CALCULATED 2200-M/S CROSS SECTIONS AND RESONANCE INTEGLALS

                     2200-M/SEC   RES.INTEG.   REF.
          ELASTIC      2.06 B         -          -
          CAPTURE      2.10 B        1.1 B      /1/
          TOTAL        4.16 B         -          -

MF=3  NEUTRON CROSS SECTIONS
     BELOW 200 KEV
        BACKGROUND DATA FOR MT=1 : (MT=107)-CROSS SECTIONS.
      MT=107 (N,A)=0.04 B (10**-5 EV), 0.0043 B (2200M/S)/1/,
             INT=5.
     ABOVE 200 KEV
      MT=1,2,4,51-54,91,102  TOTAL, ELASTIC, INELASTIC AND CAPTURE
         CALCULATED WITH CASTHY CODE /2/, CONSIDERING THE
       COMPETITION WITH THE THRESHOLD REACTION CHANNELS.
       OPTICAL POTENTIAL PARAMETERS OF C.Y.FU/3/ ARE USED.
       THE SPHERICAL OPTICAL POTENTIAL PARAMETERS:
            V = 46.72          VSO= 5.37     (MEV)
            WS=  9.13          WV = 0.0      (MEV)
            R =RSO= 1.26       RS = 1.39     (FM)
            A =ASO= 0.76       B  = 0.40     (FM)
      MT=102  CAPTURE DATA ARE NORMALIZED TO 4.2 MB AT 200 KEV.
         THE DISCRETE LEVEL SCHEME TAKEN FROM REF./4/:
            NO.       ENERGY(MEV)     SPIN-PARITY
           (G.S)       0.0             3/2    +
             1         2.523           1/2    +
             2         2.814           7/2    -
             3         3.019           3/2    -
             4         3.598           9/2    -
       CONTINUUM LEVELS ASSUMED ABOVE 3.8 MEV. THE LEVEL
       DENSITY PARAMETERS OF ASANO ET AL./5/ ARE USED.
    ***** JENDL-3.2 ******************************************
    THE TOTAL AND INELASTIC SCATTERING CROSS SECTIONS WERE CAL-
    CULATED BY USING THE OMP SET DETERMINED BY T. WATANABE.
           V = 54.36 - 0.325EN   (MEV)
           WS= 2.258 + 0.1698EN  (MEV)
           VSO=3.341             (MEV)
           R  =1.20  ,A  =0.658  (FM)
           RS =1.32  ,B  =0.602  (FM)
           RSO=1.10  ,ASO=0.406  (FM)
    THE CROSS SECTIONS OF MT=16,22,28,103,107 IN JENDL-3.1 WERE
    CONSIDERED AS THE COMPETING PROCESS FOR THE STATISTICAL MODEL
    CALCULATION.
    **********************************************************
    200 KEV - 1.0 MEV
      MT=107 (N,A)-CROSS SECTION = 2.6*10**-5 B (CONSTANT):
         ASSUMED FROM THE CALCULATED VALUE AT 1.0 MEV.
    ABOVE 1.0 MEV
      MT=16,22,28,103,107  (N,2N), (N,NA), (N,NP), (N,P), (N,A)
         BASED ON THE STATISTICAL MODEL CALCULATIONS WITH GNASH
       CODE/6/, WITHOUT THE PRECOMPOUND REACTION CORRECTION.
       TRANSMISSION COEFFICIENTS FOR PROTON AND ALPHA PARTICLE
       ARE CALCULATED BY USING THE OMP OF BECCHETTI-GREENLEES
       /7/ AND HUIZENGA-IGO/8/, RESPECTIVELY.
       LEVEL DENSITY PARAMETERS ARE BASED ON BUILT-IN VALUES.
         AT THE ENERGY RANGE OF 4 - 20 MEV, (N,P) CROSS SECTION
       WAS BASED ON THE EXPERIMENTAL DATA/9-11/.
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      MT=251  MU-BAR
         CALCULATED WITH OPTICAL MODEL (CASTHY).

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
     MT=2  CALCULATED WITH OPTICAL MODEL (CASTHY).
     MT=51-54  CALCULATED WITH HAUSER-FESHBACH FORMULA (CASTHY)
     MT=16,22,28  ISOTROPIC IN THE LABORATORY SYSTEM.
     MT=91        ISOTROPIC DISTRIBUTIONS IN CM WERE CONVERTED
                  TO THE DISTRIBUTIONS IN LAB.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
     MT=16,22,28,91,103,107  EVAPORATION SPECTRA.
```

REFERENCES


```
 1) MUGHABGHAB, S.F. ET AL.: NEUTRON CROSS SECTION, VOL.1 (1981).
 2) IGARASI, S.: J. NUCL. SCI. TECH., 12, 67 (1975).
 3) FU, C.Y.: ATOM. DATA AND NUCL. DATA TABLES., 17, 127 (1976).
 4) LEDERER, C.M. ET AL.: TABLE OF ISOTOPES. 7TH EDIT.
 5) ASANO ET AL.: PRIVATE COMMUNICATION.
 6) YOUNG, P.G. AND  ARTHUR, E.D.: LA-6947 (1977).
 7) BECCHETI, JR. AND GREENLEES, G.W.: POLARIZATION PHENOMENA
   IN NUCLEAR REACTIONS, P.682 (1971).
 8) HUIZENGA, JR. AND IGO, G.J.: NUCL. PHYS., 29, 462 (1962).
 9) BASS, R. ET AL.: NUCL. PHYS., 56, 569 (1964).
10) BORMANN, M. ET AL.: ZEITSCHRIFT F. NATURFORSCHUNG, SECTION A,
   15, 200 (1960).
11) ALEKSANDROV,D.V. ET AL.: ATOMNAYA ENERGIYA, 39(2), 137 (1975).
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MAT number = 1928

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 19-K - 40 FUJI E.C.  EVAL-MAY87 H.NAKAMURA
                      DIST-SEP89 REV2-FEB94
HISTORY
87-05  NEWLY EVALUATED BY H.NAKAMURA (FUJI ELECTRIC CO. LTD.)
94-02  JENDL-3.2
       TOTAL CROSS SECTION WAS CALCULATED BY T. WATANABE (KHI).
       INELASTIC SCATTERING CROSS SECTIONS WERE CALCULATED BY
       K.SHIBATA (JAERI).
       DATA WERE COMPILED BY K.SHIBATA.
*****  MODIFIED PARTS FOR JENDL-3.2 ****************************
(3,1),(3,4),(3,51-91),(3,251),(4,2),(4,51-55)
              NEW OPTICAL AND STATISTICAL MODEL CAL.
(3,2)         TOTAL - NONELASTIC
***************************************************************

MF=1  GENERAL INFORMATION
     MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2 MT=151  RESONANCE PARAMETERS: (NOT GIVEN )

MF=3  NEUTRON CROSS SECTIONS
  BELOW 30 KEV
        ASSUMED OR INTERPOLATED CROSS SECTIONS,GUIDED BY
      THOSE OF K-39:
              (10**-5) (2200M/S)   (5.10**2)  (3.10**4)  RES.INT
       MT=2       2.75B    2.75 B      2.75  B    2.75  B    -
       MT=102  1509.0 B   30.0  B /1/  0.2   B    0.023 B  13.45 B
       MT=103   370.0 B    4.4  B /1/  0.012 B    0.012 B    -
       MT=107     2.2 B    0.39 B /1/  0.04  B    0.015 B    -
       MT=1    1884.0 B   37.54 B      3.016 B    2.8   B    -
  30 KEV - 1.0 MEV
     MT=1,2,4,102 : CALCULATED WITH CASTHY CODE /2/.
     MT=103 : 0.012 B, GUIDED BY MEASUREMENTS OF H.WEIGMANN/3/.
  ABOVE 30 KEV.
     MT=1,2,4,51-91,102
        TOTAL, ELASTIC, INELASTIC AND CAPTURE CALCULATION WITH
      CASTHY CODE /2/, CONSIDERING THE COMPETITION WITH THE
      THE THRESHOLD REACTION CHANNELS.
        OPTICAL POTENTIAL PARAMETERS OF C.Y.FU/3/ ARE USED.
      THE SPHERICAL OPTICAL POTENTIAL PARAMETERS :
            V = 46.72      VSO= 5.37     (MEV)
            WS= 9.13       WV = 0.0      (MEV)
            R =RSO= 1.26   RS = 1.39     (FM)
            A =ASO= 0.76   B  = 0.40     (FM)
        MT=102 CAPTURE DATA ARE NORMALIZED TO 4.2 MB AT 200 KEV.
        THE DISCRETE LEVEL SCHEME TAKEN FROM REF. /4/ :
            NO.      ENERGY(MEV)     SPIN-PARITY
           (G.S.)      0.0             4   -
              1        0.0296          3   -
              2        0.800           2   -
              3        0.892           5   -
              4        1.644           0   +
              5        1.959           2   +
      CONTINUUM LEVELS ASSUMED ABOVE 2.1 MEV. THE LEVEL
      DENSITY PARAMETERS OF ASANO ET AL./5/ ARE USED.
    ***** JENDL-3.2 ******************************************
    THE TOTAL AND INELASTIC SCATTERING CROSS SECTIONS WERE CAL-
    CULATED BY USING THE OMP SET DETERMINED BY T. WATANABE.
           V = 54.36 - 0.325EN   (MEV)
           WS= 2.258 + 0.1698EN  (MEV)
           VSO=3.341             (MEV)
           R  =1.20  ,A  =0.658  (FM)
           RS =1.32  ,B  =0.602  (FM)
           RSO=1.10  ,ASO=0.406  (FM)
    THE CROSS SECTIONS OF MT=16,22,28,103,107 IN JENDL-3.1 WERE
    CONSIDERED AS THE COMPETING PROCESS FOR THE STATISTICAL MODEL
    CALCULATION.
    **********************************************************
     MT=16(N,2N), 22(N,N'A), 28(N,N'P), 103(N,P), 107(N,A)
        BASED ON THE STATISTICAL MODEL CALCULATIONS WITH GNASH
      CODE /6/, WITHOUT THE PRECOMPOUND REACTION CORRECTION.
      TRANSMISSION COEFFICIENTS FOR PROTON AND ALPHA PARTICLE
      ARE CALCULATED BY USING THE OMP OF BECCHETTI-GEENLEES
      /7/ AND HUIZENGA-IGO/8/, RESPECTIVELY.
        LEVEL DENSITY PARAMETERS ARE BASED ON BUILT -IN VALUES.
     MT=251  MU-BAR
        CALCULATED WITH OPTICAL MODEL (CASTHY).

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
     MT=2   CALCULATED WITH OPTICAL MODEL (CASTHY).
     MT=51-55  CALCULATED WITH HAUSER-FESHBACH FORMULA(CASTHY)
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     MT=16,22,28  ISOTROPIC IN THE LABORATORY SYSTEM.
     MT=91        ISOTROPIC DISTRIBUTIONS IN CM WERE CONVERTED
                  TO THE DISTRIBUTIONS IN LAB.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
     MT=16,22,28,91,103,107 EVAPORATION SPECTRA.
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REFERENCES

1) MUGHABGHAB, S.F. ET AL.: NEUTRON CROSS SECTION, VOL.1 (1981).
2) IGARASI, S.: J. NUCL. SCI. TECH., 12, 67 (1975).
3) WEIGMANN, H.: NESTOR DATA.
4) FU, C.Y.: ATOM. DATA AND NUCL. DATA TABLES., 17, 127 (1976).
5) LEDERER, C.M. ET AL.: TABLE OF ISOTOPES. 7TH EDIT.
6) ASANO ET AL.: PRIVATE COMMUNICATION.
7) YOUNG, P.G. AND ARTHUR, E.D.: LA-6947 (1977).
8) BECCHETI, JR. AND GREENLEES, G.W.: POLARIZATION PHENOMENA IN NUCLEAR REACTIONS, P.682 (1971).
9) HUIZENGA, JR. AND IGO, G.J.: NUCL. PHYS., 29, 462 (1962).

MAT number = 1931

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 19-K - 41 FUJI E.C.  EVAL-MAY87 H.NAKAMURA
                      DIST-SEP89 REV2-FEB94
HISTORY
87-05  NEWLY EVALUATED BY H.NAKAMURA (FUJI ELECTRIC CO. LTD.)
94-02  JENDL-3.2
       TOTAL CROSS SECTION WAS CALCULATED BY T. WATANABE (KHI).
       INELASTIC SCATTERING CROSS SECTIONS WERE CALCULATED BY
       K.SHIBATA (JAERI).
       DATA WERE COMPILED BY K.SHIBATA.
*****  MODIFIED PARTS FOR JENDL-3.2 ***************************
(3,1),(3,4),(3,51-91),(3,251),(4,2),(4,51-52)
              NEW OPTICAL AND STATISTICAL MODEL CAL.
(3,2)         TOTAL - NONELASTIC
***************************************************************

MF=1  GENERAL INFORMATION
     MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2 MT=151  RESONANCE PARAMETERS:
        RESOLVED RESONANCES FOR MLBW FORMULA: 1.0E-5 EV - 125 KEV
      PARAMETERS ARE TAKEN FROM BNL 325 4TH EDITION /1/, AND
      SOME PARAMETERS ARE ASSUMED TO FIT THE MEASURED DATA.
      CROSS SECTIONS CALCULATED WITH THESE PARAMETERS ARE TO
      BE CORRECTED BY ADDING MF=3, MT=1, 2 AND 102 DATA.
      CALCULATED 2200-M/S CROSS SECTIONS AND RESONANCE INTEGRALS

                 2200-M/SEC   RES. INTEG.    REF.
         ELASTIC     2.57 B       -            -
         CAPTURE     1.46 B      1.58 B       /1/
         TOTAL       4.03 B       -            -

MF=3  NEUTRON CROSS SECTIONS
   BELOW 125 KEV
     MT=251  MU-BAR= 0.0164
   ABOVE 125 KEV.
     MT=1,2,4,51-,91,102
        TOTAL, ELASTIC, INELASTIC AND CAPTURE CALCULATED WITH
      CASTHY CODE /2/, CONSIDERING THE COMPETITION WITH THE
      THRESHOLD REACTION CHANNELS.
        OPTICAL POTENTIAL PARAMETERS OF C.Y.FU/3/ ARE USED.
      THE SPHERICAL OPTICAL POTENTIAL PARAMETERS:
              V = 46.72       VSO= 5.37       (MEV)
              WS= 9.13        WV = 0.0        (MEV)
              R =RSO= 1.26    RS = 1.39       (FM)
              A =ASO= 0.76    B  = 0.40       (FM)
        MT=102  CAPTURE DATA ARE NORMALIZED TO THE EXPERIMENTAL
      DATA OF 15 MB AT 150 KEV /4/ .
        THE DISCRETE LEVEL SCHEME TAKEN FROM REF./5/:
              NO.      ENERGY(MEV)     SPIN-PARITY
            (G.S.)       0.0             3/2     +
               1         0.9804          1/2     +
               2         1.294           7/2     -
      CONTINUUM LEVELS ASSUMED ABOVE 1.5 MEV. THE LEVEL
      DENSITY PARAMETERS OF ASANO ET AL./6/ ARE USED.
    ***** JENDL-3.2 *******************************************
    THE TOTAL AND INELASTIC SCATTERING CROSS SECTIONS WERE CAL-
    CULATED BY USING THE OMP SET DETERMINED BY T. WATANABE.
           V = 54.36 - 0.325EN   (MEV)
           WS= 2.258 + 0.1698EN  (MEV)
           VSO=3.341             (MEV)
           R  =1.20   ,A  =0.658  (FM)
           RS =1.32   ,B  =0.602  (FM)
           RSO=1.10   ,ASO=0.406  (FM)
    THE CROSS SECTIONS OF MT=16,22,28,103,107 IN JENDL-3.1 WERE
    CONSIDERED AS THE COMPETING PROCESS FOR THE STATISTICAL MODEL
    CALCULATION.
    ***********************************************************
     MT=16(N,2N), 22(N,N'A), 28(N,N'P), 103(N,P), 107(N,A)
        BASED ON THE STATISTICAL MODEL CALCULATIONS WITH GNASH
      CODE /7/, WITHOUT THE PRECOMPOUND REACTION CORRECTION .
      TRANSMISSION COEFFICIENTS FOR PROTON AND ALPHA PARTICLE
      ARE CALCULATED BY USING THE OMP OF BECCHETTI-GEENLEES
      /8/ AND HUIZENGA-IGO/9/, RESPECTIVELY.
        LEVEL DENSITY PARAMETERS ARE BASED ON BUILT-IN VALUES.
        (N,2N), (N,P) AND (N,A) CROSS SECTIONS WERE NORMALIZED
      TO THE EXPERIMENTAL DATA OF ADAM+/10/ FOR (N,2N), AND OF
      BASS+/11/ FOR (N,P) AND (N,A).
     MT=251  MU-BAR
        CALCULATED WITH OPTICAL MODEL   (CASTHY).

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
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     MT=2  CALCULATED WITH OPTICAL MODEL (CASTHY).
     MT=51-52  CALCULATED WITH HAUSER -FESHBACH FORMULA (CASTHY)
     MT=16,22,28  ISOTROPIC IN THE LABORATORY SYSTEM.
     MT=91        ISOTROPIC DISTRIBUTIONS IN CM WERE CONVERTED
                  TO THE DISTRIBUTIONS IN LAB.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
     MT=16,22,28,91,103,107  EVAPORATION SPECTRA.
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REFERENCES


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 1) MUGHABGHAB, S.F. ET AL.: NEUTRON CROSS SECTION, VOL.1 (1981).
 2) IGARASI, S.: J. NUCL. SCI. TECH., 12, 67 (1975).
 3) FU, C.Y.: ATOM. DATA AND NUCL. DATA TABLES., 17, 127 (1976).
 4) STUPEGIA ET AL.: J. NUCL. ENERG., 22, 267 (1968).
 5) LEDERER, C.M. ET AL.: TABLE OF ISOTOPES. 7TH EDIT.
 6) ASANO ET AL.: PRIVATE COMMUNICATION.
 7) YOUNG, P.G. AND ARTHUR, E.D.: LA-6947 (1977).
 8) BECCHETI, JR. AND GREENLEES, G.W.: POLARIZATION PHENOMENA
    IN NUCLEAR REACTIONS, P.682 (1971).
 9) HUIZENGA, JR. AND IGO, G.J.: NUCL. PHYS., 29, 462 (1962).
10) ADAM, A. ET AL.: NUCL. PHYS., A180, 587 (1972).
11) BASS, R.ET AL.: EANDC(E)-57U, 1 (1965).
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MAT number = 2000
 20-CA-  0 DEC          EVAL-MAR87 M.HATCHYA(DATA ENG. CO.)
                        DIST-SEP89 REV2-APR94
HISTORY
87-03 NEW EVALUATION WAS MADE TO GIVE A FULL REVISION FOR JENDL-2
      DATA.
87-03 COMPILED BY T.ASAMI(NEDAC)
90-06 MF=3,MT=251 AND AWR'S OF MF=4 WERE MODIFIED.
94-04 JENDL-3.2.
       GAMMA PRODCTION DATA MODIFIED BY T.ASAMI (DATA ENG.)
       OTHER DATA WERE MAINLY ADOPTED FROM JENDL FUSION FILE.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      ALL CROSS SECTIONS EXCEPT (3,1), (3,16), (3,103), (3,107)
                                AND (3,111)
      ALL ANGULAR DISTRIBUTIONS EXCEPT (4,2).
      ALL ENERGY DISTRIBUTIONS.
      (12,4), (12,102), (12,103), (12,107)
      (13,3), (13,4)
      (15,102), (15,103), (15,107)
     ***********************************************************
     --------------------------------------------------------------
      JENDL FUSION FILE /1/  (AS OF JAN. 1994)
            EVALUATED BY K.KOSAKO (NEDAC) AND S.CHIBA (NDC/JAERI)
            COMPILED  BY K.KOSAKO.

      -  NATURAL CA DATA WERE CONSTRUCTED FROM DATA FOR ISOTOPES.
      -  THE INELASTIC SCATTERING CROSS SECTIONS AND ANGULAR
         DISTRIBUTIONS OF INELASTICALLY SCATTERED NEUTRONS (EXCEPT
         CONTINUUM INELASTIC) WERE CALCULATED WITH CASTHY2Y AND
         DWUCKY IN SINCROS-II SYSTEM/2/ INCLUDING CONTRIBUTIONS
         FROM DIRECT REACTIONS.
      -  THE (N,2N), (N,NA) AND (N,NP) REACTION CROSS SECTIONS
         (MT=16, 22, 28) WERE CALCULATED BY EGNASH2 IN THE
         SINCROS-II.
      -  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE REPLACED
         BY THOSE CALCULATED BY EGNASH2.  THE DDX'S OF THE
         CONTINUUM NEUTRONS WERE CALCULATED BY KUMABE'S SYSTEMA-
         TICS /3/ USING F15TOB /1/.  THE PRECOMPOUND/COMPOUND
         RATIO WAS CALCULATED BY THE SINCROS-II CODE SYSTEM.
      -  THE RESONANCE PARAMETERS, CAPTURE, (N,P), (N,A) AND
         (N,2P) CROSS SECTIONS AND ANGULAR DISTRIBUTIONS OF
         ELASTICALLY SCATTERED NEUTRONS WERE TAKEN FROM JENDL-3.1.
      -  OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED IN
         THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./2/.
         LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/4/.
     --------------------------------------------------------------


MF=1  GENERAL INFORMATION
 MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
 MT=151  RESOLVED RESONANCE PARAMETERS
   RESOLVED PARAMETERS FOR MLBW FORMULA WERE GIVEN IN THE ENERGY
   REGION FROM 1.0E-5 EV TO 500 KEV.
   THE DATA WERE CONSTRUCTED FROM THE EVALUATED RESONANCE
   PARAMETERS FOR EACH CA ISOTOPE EXCEPT FOR CA-46, CONSIDERING
   THEIR ABUNDANCES IN THE CA ELEMENT/5/.

            2200 M/S CROSS SECTION(B)     RES. INTEGRAL(B)
    ELASTIC      3.0193
    CAPTURE      0.4358                     0.2262
    TOTAL        3.4551

MF=3  NEUTRON CROSS SECTIONS
   BELOW 500 KEV, BACKGROUND CROSS SECTION WAS GIVEN.  THE TOTAL,
   ELASTIC SCATTERING AND CAPTURE CROSS SECTIONS OF CA-42 IN THE
   ENERGIES OF 300 TO 500 KEV AND OF CA-43 IN THE ENERGIES OF 40
   TO 500 KEV, MULTIPLIED BY THEIR ABUNDANCES, WERE GIVEN AS THE
   BACKGROUND CROSS SECTIONS FOR MT=1, 2 AND 102, RESPECTIVELY.

   ABOVE 500 KEV, ALL THE CROSS SECTIONS EXCEPT FOR THE TOTAL WERE
   CONSTRUCTED FROM THE EVALUATED ONES FOR STABLE ISOTOPES.

 MT=1 TOTAL
   THE DATA IN THE ENERGIES ABOVE 500 KEV WERE EVALUATED BASED ON
   MAINLY THE EXPERIMENTAL ONES OF/6, 7/ BY FOLLOWING THEIR FINE
   STRUCTURES.

 MT=2 ELASTIC SCATTERING
```

OBTAINED BY SUBTRACTING THE SUM OF THE PARTIAL CROSS SECTIONS
FROM THE TOTAL CROSS SECTION.

MT=4, 51-84, 91 INELASTIC SCATTERING
TAKEN FROM JENDL FUSION FILE WHICH WAS CONSTRUCTED FROM THOSE
OF CA ISOTOPES AS FOLLOWS:

MT	ENERGY(MEV)	CA-40	CA-42	CA-43	CA-44	CA-46	CA-48
51	0.3728			51			
52	0.5934			52			
53	0.9903			53			
54	1.157				51		
55	1.346			54		51	
56	1.5246		51				
57	1.6778			55			
58	1.8373		52		52		
59	1.9018			56			
60	1.9314			57,58			
61	2.2831				53		
62	2.4231		53			52	
63	2.5747					53	
64	2.6565				54		
65	2.7523		54				
66	2.9739					54	
67	3.0226				55	55	
68	3.1893		55				
69	3.2539		56		56		
70	3.300		57		57,58		
71	3.3521	51			59		
72	3.391		58,59				
73	3.614		60			56,57	
74	3.7369	52					
75	3.8317					58	51
76	3.9045	53					
77	4.2842						52
78	4.4915	54					
79	5.2129	55					
80	5.2488	56					
81	5.2788	57					
82	5.6142	58					
83	5.6296	59					
84	5.9033	60					
91	1.957	91	91	91	91	91	91

MT=16, 22, 28, 102, 103, 107, 111
(N,2N), (N,NA), (N,NP), CAPTURE, (N,P), (N,A) AND (N,2P)
CONSTRUCTED FROM THE EVALUATED DATA FOR CA ISOTOPES. THE DATA
FOR MT=103, 107 AND 111 ARE THE SAME AS JENDL-3.1. THOSE OF
MT=22 AND 28 WERE MAINLY TAKEN FROM JENDL FUSION FILE. THE
CAPTURE CROSS SECTION ABOVE 3 MEV WAS LARGELY CHANGED FROM
JENDL-3.1 BRCAUSE OF CA-40.

MT=251 MU-BAR
CALCULATED WITH THE OPTICAL MODEL.

MF=4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=2
CALCULATED WITH THE CASTHY CODE/8/.
MT=51-84
TAKEN FROM JENDL FUSION FILE.
MT=16, 22, 28, 91
TAKEN FROM JENDL FUSION FILE, AND TRANSFORMED INTO THE LAB
SYSTEM.

MF=5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=16, 22, 28, 91
TAKEN FROM JENDL FUSION FILE, AND TRANSFORMED INTO THE LAB
SYSTEM.

MF=12 PHOTON PRODUCTION MULTIPLICITIES
MT=102 (BELOW 4 MEV)
CALCULATED FROM ENERGY BALANCE.
MT=103, 107 (BELOW 4 MEV)
CALCULATED WITH THE GNASH CODE/9/.

MF=13 PHOTON PRODUCTION CROSS SECTIONS
MT=3 (ABOVE 4 MEV)
CALCULATED WITH THE GNASH CODE/9/.
MT=4 (BELOW 4 MEV)
CALCULATED FROM THE INELASTIC SCATTRING CROSS SECTIONS AND THE
TRANSITION PROBABILITIES OF ISOTOPES.

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MF=14  PHOTON ANGULAR DISTRIBUTIONS
 MT=3, 4, 102, 103, 107
    ASSUMED TO BE ISOTROPIC IN THE LABORATORY SYSTEM.

MF=15  CONTINUOUS PHOTON ENERGY SPECTRA
 MT=3, 103, 107
    CALCULATED WITH THE GNASH CODE/9/.
 MT=102
    ASSUMED TO BE THE SAME AS THOSE OF CA-40 WHICH WERE CALCULATED
    WITH CASTHY BELOW 10 KEV AND WITH GNASH ABOVE 200 KEV.
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REFERENCES


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 1) CHIBA, S. ET AL.: JAERI-M 92-027, P.35 (1992).
 2) YAMAMURO, N.: JAERI-M 90-006 (1990).
 3) KUMABE, I. ET AL.: NUCL. SCI. ENG., 104, 280 (1990).
 4) ENSDF: EVALUATED NUCLEAR STRUCTURE DATA FILE, BNL/NNDC.
 5) HOLDEN N.E., MARTIN R.L. AND BARNES I.L. : PURE & APPL.
    CHEM. 56, 675 (1984).
 6) CIERJACKS S. ET AL. : KFK-1000 (1968).
 7) FOSTER JR. D.G. ET AL. : PHYS. REV. C3, 576 (1971).
 8) IGARASI S. AND FUKAHORI T.: JAERI 1321 (1991).
 9) YOUNG P.G. AND ARTHUR E.D. : LA-6947 (1977).
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MAT number = 2025

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 20-CA- 40 DEC        EVAL-MAR87 M.HATCHYA(DATA ENG. CO.)
                      DIST-SEP89 REV2-APR94
HISTORY
87-03 NEW EVALUATION WAS MADE TO GIVE A FULL REVISION FOR JENDL-2
      DATA.
87-03 COMPILED BY T.ASAMI(NEDAC)
94-04 JENDL-3.2.
       GAMMA PRODCTION DATA MODIFIED BY T.ASAMI (DATA ENG.)
       OTHER DATA WERE MAINLY ADOPTED FROM JENDL FUSION FILE.
      COMPILED BY T.NAKAGAWA

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      ALL CROSS SECTIONS EXCEPT (3,103), (3,107) AND (3,111)
      ALL ANGULAR DISTRIBUTIONS EXCEPT (4,2).
      ALL ENERGY DISTRIBUTIONS.
      (12,4), (12,102), (12,103), (12,107)
      (13,3)
      (15,102)
     ***********************************************************
     -------------------------------------------------------------
      JENDL FUSION FILE /1/  (AS OF NOV. 1993)
            EVALUATED BY K.KOSAKO (NEDAC) AND S.CHIBA (NDC/JAERI)
            COMPILED  BY K.KOSAKO.

      -  THE TOTAL CROSS SECTION WAS MODIFIED IN THE ENERGY RANGE
         ABOVE 10 MEV.
      -  THE INELASTIC SCATTERING CROSS SECTIONS AND ANGULAR
         DISTRIBUTIONS OF INELASTICALLY SCATTERED NEUTRONS (EXCEPT
         CONTINUUM INELASTIC) WERE CALCULATED WITH CASTHY2Y AND
         DWUCKY IN SINCROS-II SYSTEM/2/ INCLUDING CONTRIBUTIONS
         FROM DIRECT REACTIONS.
      -  THE (N,2N), (N,NA) AND (N,NP) REACTION CROSS SECTIONS
         (MT=16, 22, 28) WERE CALCULATED BY EGNASH2 IN THE
         SINCROS-II.
      -  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE REPLACED
         BY THOSE CALCULATED BY EGNASH2.  THE DDX'S OF THE
         CONTINUUM NEUTRONS WERE CALCULATED BY KUMABE'S SYSTEMA-
         TICS /3/ USING F15TOB /1/.  THE PRECOMPOUND/COMPOUND
         RATIO WAS CALCULATED BY THE SINCROS-II CODE SYSTEM.
      -  THE RESONANCE PARAMETERS, CAPTURE, (N,P), (N,A) AND
         (N,2P) CROSS SECTIONS AND ANG.  DISTRIBUTIONS OF
         ELASTICALLY SCATTERED NEUTRONS WERE TAKEN FROM JENDL-3.1.
      -  OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED IN
         THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./2/.
         LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/4/.
     -------------------------------------------------------------


MF=1  GENERAL INFORMATION
 MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
 MT=151  RESOLVED RESONANCE PARAMETERS
   RESOLVED PARAMETERS FOR MLBW FORMULA WERE GIVEN IN THE ENERGY
   REGION FROM 1.0E-5 EV TO 500 KEV.  PARAMETERS WERE TAKEN FROM
   THE RECOMMENDED DATA OF BNL/5/ AND THE DATA FOR A NEGATIVE
   RESONANCE WERE ADDED SO AS TO REPRODUCE THE RECOMMENDED THERMAL
   CROSS SECTIONS FOR CAPTURE AND SCATTERNG/5/.  THE SCATTERING
   RADIUS WAS ASSUMED TO BE 3.6 FERMI.  CALCULATED 2200 M/SEC
   CROSS SECTIONS AND RESONANCE INTEGRALS ARE AS FOLLOWS:

           2200 M/S CROSS SECTION(B)     RES. INTEGRAL(B)
   ELASTIC      3.022
   CAPTURE      0.408                       0.2125
   TOTAL        3.430

MF=3  NEUTRON CROSS SECTIONS
   BELOW 500 KEV, ZERO BACKGROUND CROSS SECTION WAS GIVEN AND ALL
   THE CROSS-SECTION DATA ARE REPRODUCED FROM THE EVALUATED
   RESOLVED RESONANCE PARAMETERS WITH MLBW FORMULA.

   FOR JENDL-3.2, ALL CROSS-SECTION DATA EXCEPT FOR THE CAPTURE,
   (N,P) AND (N,A) CROSS SECTIONS WERE ADOPTED FROM JENDL FUSION
   FILE.  THEIR CALCULATION WAS MADE WITH SINCROS-II SYSTEM/2/ BY
   ADOPTING WALTER-GUSS OMP MODIFIED BY YAMAMURO/2/ FOR NEUTRON,
   PEREY OMP /6/ FOR PROTON, LEMOS OMP MODIFIED BY ARTHUR AND
   YOUNG/7/ FOR ALPHA, LOHR-HAEBERLI OMP/8/ FOR DEUTERON,
   BECCHETTII-GREENLEES OMP/9/ FOR TRITON AND HE-3, AND STANDARD
   LEVEL DENSITY PARAMETERS OF SINCROS-II SYSTEM.

 MT=1 TOTAL
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    OPTICAL AND STATISTICAL MODEL CALCULATION WAS MADE WITH
    CASTHY /10/. THE OPTICAL POTENTIAL PARAMETERS USED ARE:
        V = 49.68,               VSO = 7.12    (MEV)
       WS = 7.76 - 0.5*EN,        WV = 0       (MEV)
        R = 1.17,   RS = 1.09,   RSO = 1.17    (FM)
        A = 0.6,   ASO = 0.6,      B = 0.69    (FM)
    ABOVE 10 MEV, MODIFIED TO REPRODUCE THE EXPERIMENTAL DATA/11,
    12/.

  MT=2 ELASTIC SCATTERING
    OBTAINED BY SUBTRACTING THE SUM OF THE PARTIAL CROSS SECTIONS
    FROM THE TOTAL CROSS SECTION.

  MT=4, 51-60, 91 INELASTIC SCATTERING
    THE CROSS SECTIONS WERE TAKEN FROM JENDL FUSION FILE.  THE
    LEVEL SCHEME WAS BASED ON REF./4/  CONTRIBUTIONS OF THE
    DIRECT PROCESS WERE CALCULATED FOR THE LEVELS MARKED WITH '*',
    USING DEFORMATION PARAMETERS COMPILED BY RAMAN ET AL./13/ AND
    SPEAR/14/.
          NO.     ENERGY(MEV)    SPIN-PARITY (DIRECT PROCESS)
                    0.0            0 +
           1        3.3521         0 +
           2        3.7369         3 -           *
           3        3.9045         2 +           *
           4        4.4915         5 -           *
           5        5.2129         0 +
           6        5.2488         2 +
           7        5.2788         4 +           *
           8        5.6142         4 -           *
           9        5.6296         2 +
          10        5.9033         1 -
    LEVELS ABOVE 5.903 MEV WERE ASSUMED TO BE OVERLAPPING.  THE
    DIRECT INELASTIC SCATTERING CROSS SECTIONS WERE CALCULATED FOR
    THE LEVELS AT 6.026, 6.286, 6.583, 6.751, 7.114, 7.466, 7.659,
    8.099 AND 8.424 MEV, AND ADDED TO MT=91.

  MT=16      (N,2N)
    THE CALCULATION FOR JENDL FUSION FILE WAS NOT ADOPTED.  THIS
    CROSS SECTION FOR JENDL-3.1 WAS EVALUATED ON THE BASIS OF
    EXPERIMENTAL DATA OF ARNORD ET AL./15/  THE THRESHOLD ENERGY
    WAS SLIGHTLY MODIFIED FOR JENDL-3.2.

  MT=22, 28  (N,NA),(N,NP)
    ADOPTED FROM JENDL FUSION FILE.  THEORETICAL CALCULATION WAS
    MADE WITH SINCROS-II.

  MT=102     CAPTURE
    CALCULATED WITH THE CASTHY CODE/16/ AND NORMALIZED TO 6.7 MB
    AT 30 KEV.  ABOVE 5.38 MEV, CROSS SECTIONS WERE DETERMINED
    ON THE BASIS OF THE EXPERIMENTAL DATA/17,18/.

  MT=103, 107, 111   (N,P), (N,A), (N,2P)
    CALCULATED WITH THE GNASH CODE/19/ USING THE ABOVE MENTIONED
    OPTICAL MODEL PARAMETERS.  THE (N,P) CROSS SECTIONS WERE
    NORMALIZED SO AS TO FIT TO THE EXPERIMENTAL DATA OF URECH AT
    5.95 MEV/20/.  THE (N,A) CROSS SECTIONS WERE NORMALIZED TO THE
    EXPERIMENTAL DATA OF BARNES/21/ AT 14.1 MEV.

  MT=251     MU-BAR
    CALCULATED WITH THE OPTICAL MODEL.

 MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2
     CALCULATED WITH THE CASTHY CODE/10/.
  MT=51-60
     TAKEN FROM JENDL FUSION FILE CALCULATED WITH THE CASTHY AND
     DWUCKY IN THE SINCROS-II SYSTEM.
  MT=16, 22, 28, 91
     TAKEN FROM JENDL FUSION FILE, AND TRANSFORMED INTO THE LAB
     SYSTEM.

 MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16, 22, 28, 91
     TAKEN FROM JENDL FUSION FILE, AND TRANSFORMED INTO THE LAB
     SYSTEM.

 MF=12  PHOTON PRODUCTION MULTIPLICITIES
  MT=4 (UP TO 4.0 MEV)
     MULTIPLICITY OF 1.0 WAS GIVEN.
  MT=102 (UP TO 4.0 MEV)
     FROM ENERGY BALANCE.
  MT=103, 107
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CALCULATED WITH THE GNASH CODE/19/.

MF=13 PHOTON PRODUCTION CROSS SECTIONS
MT=3 (ABOVE 4.0 MEV)
CALCULATED WITH THE GNASH CODE/19/.

MF=14 PHOTON ANGULAR DISTRIBUTIONS
MT=4,3,102
ASSUMED TO BE ISOTROPIC IN THE LABORATORY SYSTEM.

MF=15 CONTINUOUS PHOTON ENERGY SPECTRA
MT=3, 102, 103, 107
CALCULATED WITH THE GNASH CODE/19/. CAPTURE GAMMA SPECTRAUM AT THERMAL ENERGY WAS CALCULATED WITH CASTHY/10/.

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2) YAMAMURO, N.: JAERI-M 90-006 (1990).
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16) ENSDF(EVALUATED NUCLEAR STRUCTURE DATA FILE)
17) BERGQVIST I. ET AL.: NUCL. PHYS. A231, 29 (1974).
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19) YOUNG P.G. AND ARTHUR E.D. : LA-6947 (1977).
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MAT number = 2031
 20-CA- 42 DEC        EVAL-MAR87 M.HATCHYA(DATA ENG. CO.)
                      DIST-SEP89 REV2-NOV93
HISTORY
87-03 NEW EVALUATION WAS MADE TO GIVE A FULL REVISION FOR JENDL-2
      DATA.
87-03 COMPILED BY T.ASAMI(NEDAC)
93-11 JENDL-3.2
       DATA WERE MAINLY ADOPTED FROM JENDL FUSION FILE.
      COMPILED BY T.NAKAGAWA

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      ALL CROSS SECTIONS EXCEPT (3,102), (3,103) AND (3,107)
      ALL ANGULAR DISTRIBUTIONS EXCEPT FOR (4,2).
      ALL ENERGY DISTRIBUTIONS.
     ***********************************************************
     -------------------------------------------------------------
      JENDL FUSION FILE /1/  (AS OF NOV. 1993)
            EVALUATED BY K.KOSAKO (NEDAC) AND S. CHIBA (NDC/JAERI)
            COMPILED  BY K.KOSAKO.

      -  THE INELASTIC SCATTERING CROSS SECTIONS AND ANGULAR
         DISTRIBUTIONS OF INELASTICALLY SCATTERED NEUTRONS (EXCEPT
         CONTINUUM INELASTIC) WERE CALCULATED WITH CASTHY2Y AND
         DWUCKY IN SINCROS-II SYSTEM/2/ INCLUDING CONTRIBUTIONS
         FROM DIRECT REACTIONS.
      -  THE (N,2N), (N,NA) AND (N,NP) REACTION CROSS SECTIONS
         (MT=16, 22, 28) WERE CALCULATED BY EGNASH2 IN THE
         SINCROS-II.
      -  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE REPLACED
         BY THOSE CALCULATED BY EGNASH2.  THE DDX'S OF THE
         CONTINUUM NEUTRONS WERE CALCULATED BY KUMABE'S SYSTEMA-
         TICS /3/ USING F15TOB /1/.  THE PRECOMPOUND/COMPOUND
         RATIO WAS CALCULATED BY THE SINCROS-II CODE SYSTEM.
      -  THE RESONANCE PARAMETERS, TOTAL, CAPTURE, (N,P) AND (N,A)
         CROSS SECTIONS AND ANG. DISTRIBUTIONS OF ELASTICALLY
         SCATTERED NEUTRONS WERE TAKEN FROM JENDL-3.1.
      -  OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED IN
         THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./2/.
         LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/4/.
     -------------------------------------------------------------


MF=1  GENERAL INFORMATION
 MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
 MT=151  RESOLVED RESONANCE PARAMETERS
   RESOLVED PARAMETERS FOR MLBW FORMULA WERE GIVEN IN THE ENERGY
   REGION FROM 1.0E-5 EV TO 300 KEV.  PARAMETERS WERE TAKEN FROM
   THE RECOMMENDED DATA OF BNL/5/ AND THE DATA FOR A NEGATIVE
   RESONANCE WERE ADDED SO AS TO REPRODUCE THE RECOMMENDED THERMAL
   CROSS SECTIONS FOR CAPTURE AND SCATTERING/5/.  THE SCATTERING
   RADIUS WAS ASSUMED TO BE 3.6 FERMI.  CALCULATED 2200 M/SEC
   CROSS SECTIONS AND RESONANCE INTEGRALS ARE AS FOLLOWS:

           2200 M/S CROSS SECTION(B)     RES. INTEGRAL(B)
   ELASTIC      1.222
   CAPTURE      0.683                       0.3762
   TOTAL        1.905

MF=3  NEUTRON CROSS SECTIONS
   BELOW 300 KEV, ZERO BACKGROUND CROSS SECTION WAS GIVEN AND ALL
   THE CROSS-SECTION DATA ARE REPRODUCED FROM THE EVALUATED
   RESOLVED RESONANCE PARAMETERS WITH MLBW FORMULA.

   FOR JENDL-3.2, ALL CROSS-SECTION DATA EXCEPT FOR THE TOTAL,
   CAPTURE, (N,P) AND (N,A) CROSS SECTIONS WERE ADOPTED FROM JENDL
   FUSION FILE.  THE CALCULATION WAS MADE WITH SINCROS-II SYSTEM
   /2/ BY ADOPTING WALTER-GUSS OMP MODIFIED BY YAMAMURO/2/ FOR
   NEUTRON, PEREY OMP /6/ FOR PROTON, LEMOS OMP MODIFIED BY ARTHUR
   AND YOUNG/7/ FOR ALPHA, LOHR-HAEBERLI OMP/8/ FOR DEUTERON,
   BECCHETTII-GREENLEES OMP/9/ FOR TRITON AND HE-3, AND STANDARD
   LEVEL DENSITY PARAMETERS OF SINCROS-II SYSTEM.

MT=1 TOTAL
   OPTICAL AND STATISTICAL MODEL CALCULATION WAS MADE WITH THE
   CASTHY CODE/10/. THE OPTICAL POTENTIAL PARAMETERS USED ARE:
       V = 49.68,                VSO = 7.12   (MEV)
      WS = 7.76 - 0.5*EN,          WV = 0      (MEV)
       R = 1.17,  RS = 1.09,  RSO = 1.17      (FM)
       A = 0.6,   ASO = 0.6,   B = 0.69       (FM)
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   THIS SET OF OMP WAS USED ALSO FOR CALCULATION OF THE CAPTURE,
   (N,P), (N,A) CROSS SECTION AND ELASTIC ANG. DISTRIBUTIONS.

 MT=2 ELASTIC SCATTERING
   OBTAINED BY SUBTRACTING THE SUM OF THE PARTIAL CROSS SECTIONS
   FROM THE TOTAL CROSS SECTION.

 MT=4, 51-60, 91 INELASTIC SCATTERING
   THE CROSS SECTIONS WERE TAKEN FROM JENDL FUSION FILE.  THE
   LEVEL SCHEME WAS BASED ON REF./4/  CONTRIBUTIONS OF THE
   DIRECT PROCESS WERE CALCULATED FOR THE LEVELS MARKED WITH '*',
   USING DEFORMATION PARAMETERS COMPILED BY RAMAN ET AL./11/ AND
   SPEAR/12/.
         NO.      ENERGY(MEV)    SPIN-PARITY (DIRECT PROCESS)
                   0.0              0 +
          1        1.5246           2 +          *
          2        1.8373           0 +
          3        2.4236           2 +          *
          4        2.7523           4 +          *
          5        3.1893           6 +          *
          6        3.2539           4 +
          7        3.3000           0 +
          8        3.3910           2 +
          9        3.4464           3 -          *
         10        3.6530           2 +
   LEVELS ABOVE 3.653 MEV WERE ASSUMED TO BE OVERLAPPING.

 MT=16, 22, 28   (N,2N), (N,NA),(N,NP)
   ADOPTED FROM JENDL FUSION FILE.  THEORETICAL CALCULATION WAS
   MADE WITH SINCROS-II.

 MT=102      CAPTURE
   CALCULATED WITH THE CASTHY CODE/10/ AND NORMALIZED TO 12.6 MB
   AT 45 KEV/13/.

 MT=103, 107     (N,P), (N,A)
   CALCULATED WITH GNASH/14/.

 MT=251      MU-BAR
   CALCULATED WITH THE OPTICAL MODEL.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=2
    CALCULATED WITH THE CASTHY CODE/10/.
 MT=51-60
    TAKEN FROM JENDL FUSION FILE.  CALCULATED WITH THE CASTHY AND
    DWUCKY IN THE SINCROS-II SYSTEM.
 MT=16, 22, 28, 91
    TAKEN FROM JENDL FUSION FILE, AND TRANSFORMED INTO THE LAB
    SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=16, 22, 28, 91
    TAKEN FROM JENDL FUSION FILE, AND TRANSFORMED INTO THE LAB
    SYSTEM.

REFERENCES
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 1) CHIBA, S. ET AL.: JAERI-M 92-027, P.35 (1992).
 2) YAMAMURO, N.: JAERI-M 90-006 (1990).
 3) KUMABE, I. ET AL.: NUCL. SCI. ENG., 104, 280 (1990).
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    (1987)
12) SPEAR, R.H.: ATOM. DATA AND NUCL. DATA TABLE, 42, 55 (1989).
13) MUSGROVE A.R.DE L. ET AL.: NUCL. PHYS., A279, 317 (1977).
14) YOUNG P.G. AND ARTHUR E.D. : LA-6947 (1977).
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MAT number = 2034

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 20-CA- 43 DEC         EVAL-MAR87 M.HATCHYA(DATA ENG. CO.)
                       DIST-SEP89 REV2-NOV93
HISTORY
87-03 NEW EVALUATION WAS MADE TO GIVE A FULL REVISION FOR JENDL-2
      DATA.
87-03 COMPILED BY T.ASAMI(NEDAC)
93-11 JENDL-3.2
       DATA WERE MAINLY ADOPTED FROM JENDL FUSION FILE.
      COMPILED BY T.NAKAGAWA

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (3,2), (3,4), (3,16), (3,17), (3,22), (3,28), (3,51-91)
      ALL ANGULAR DISTRIBUTIONS EXCEPT FOR (4,2).
      ALL ENERGY DISTRIBUTIONS.
     ***********************************************************
     -------------------------------------------------------------
      JENDL FUSION FILE /1/  (AS OF NOV. 1993)
            EVALUATED BY K.KOSAKO (NEDAC) AND S. CHIBA (NDC/JAERI)
            COMPILED  BY K.KOSAKO.

      -  THE INELASTIC SCATTERING CROSS SECTIONS AND ANGULAR
         DISTRIBUTIONS OF INELASTICALLY SCATTERED NEUTRONS (EXCEPT
         CONTINUUM INELASTIC) WERE CALCULATED WITH CASTHY2Y AND
         DWUCKY IN SINCROS-II SYSTEM/2/ INCLUDING CONTRIBUTIONS
         FROM DIRECT REACTIONS.
      -  THE (N,2N), (N,3N), (N,NA) AND (N,NP) REACTION CROSS
         SECTIONS (MT=16, 17, 22, 28) WERE CALCULATED BY EGNASH2
         IN THE SINCROS-II.
      -  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE REPLACED
         WITH THOSE CALCULATED BY EGNASH2.  THE DDX'S OF THE
         CONTINUUM NEUTRONS WERE CALCULATED BY KUMABE'S SYSTEMA-
         TICS /3/ USING F15TOB /1/.  THE PRECOMPOUND/COMPOUND
         RATIO WAS CALCULATED BY THE SINCROS-II CODE SYSTEM.
      -  THE RESONANCE PARAMETERS, TOTAL, CAPTURE, (N,P) AND (N,A)
         CROSS SECTIONS AND ANG. DISTRIBUTIONS OF ELASTICALLY
         SCATTERED NEUTRONS WERE TAKEN FROM JENDL-3.1.
      -  OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED IN
         THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./2/.
         LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/4/.
     -------------------------------------------------------------


MF=1  GENERAL INFORMATION
 MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
 MT=151  RESOLVED RESONANCE PARAMETERS
   RESOLVED PARAMETERS FOR MLBW FORMULA WERE GIVEN IN THE ENERGY
   REGION FROM 1.0E-5 EV TO 40 KEV.  PARAMETERS WERE TAKEN FROM
   THE RECOMMENDED DATA OF BNL/5/ AND THE DATA FOR A NEGATIVE
   RESONANCE WERE ADDED SO AS TO REPRODUCE THE RECOMMENDED THERMAL
   CROSS SECTIONS FOR CAPTURE AND SCATTERING/5/.  THE SCATTERING
   RADIUS WAS ASSUMED TO BE 3.6 FERMI.  CALCULATED 2200 M/SEC
   CROSS SECTIONS AND RESONANCE INTEGRALS ARE AS FOLLOWS:

           2200 M/S CROSS SECTION(B)     RES. INTEGRAL(B)
   ELASTIC      4.160
   CAPTURE     11.66                        5.798
   TOTAL       15.82

MF=3  NEUTRON CROSS SECTIONS
   BELOW 40 KEV, ZERO BACKGROUND CROSS SECTION WAS GIVEN AND ALL
   THE CROSS-SECTION DATA ARE REPRODUCED FROM THE EVALUATED
   RESOLVED RESONANCE PARAMETERS WITH MLBW FORMULA.

   FOR JENDL-3.2, ALL CROSS-SECTION DATA EXCEPT FOR THE TOTAL,
   CAPTURE, (N,P) AND (N,A) CROSS SECTIONS WERE ADOPTED FROM JENDL
   FUSION FILE.  THE CALCULATION WAS MADE WITH SINCROS-II SYSTEM
   /2/ BY ADOPTING WALTER-GUSS OMP MODIFIED BY YAMAMURO/2/ FOR
   NEUTRON, PEREY OMP /6/ FOR PROTON, LEMOS OMP MODIFIED BY ARTHUR
   AND YOUNG/7/ FOR ALPHA, LOHR-HAEBERLI OMP/8/ FOR DEUTERON,
   BECCHETTII-GREENLEES OMP/9/ FOR TRITON AND HE-3, AND STANDARD
   LEVEL DENSITY PARAMETERS OF SINCROS-II SYSTEM.

 MT=1 TOTAL
   OPTICAL AND STATISTICAL MODEL CALCULATION WAS MADE WITH THE
   CASTHY CODE/10/. THE OPTICAL POTENTIAL PARAMETERS USED ARE:
       V = 49.68,                VSO = 7.12   (MEV)
      WS = 7.76 - 0.5*EN,         WV = 0      (MEV)
       R = 1.17,  RS = 1.09,  RSO = 1.17      (FM)
       A = 0.6,   ASO = 0.6,   B = 0.69       (FM)
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MT=2 ELASTIC SCATTERING
  OBTAINED BY SUBTRACTING THE SUM OF THE PARTIAL CROSS SECTIONS
  FROM THE TOTAL CROSS SECTION.

MT=4, 51-58, 91 INELASTIC SCATTERING
  THE CROSS SECTIONS WERE TAKEN FROM JENDL FUSION FILE.  THE
  LEVEL SCHEME WAS BASED ON REF./4/  CONTRIBUTIONS OF THE DIRECT
  PROCESS WERE CALCULATED FOR THE LEVELS MARKED WITH '*' BY MEANS
  OF DWUCKY.

        NO.      ENERGY(MEV)    SPIN-PARITY (DIRECT PROCESS)
       G.S.       0.0              7/2-
         1        0.3728           5/2-         *
         2        0.5934           3/2-         *
         3        0.9903           3/2+         *
         4        1.3946           5/2+         *
         5        1.6778          11/2-         *
         6        1.9018           7/2+
         7        1.9314           5/2-
         8        1.9574           1/2+
   LEVELS ABOVE 1.957 MEV WERE ASSUMED TO BE OVERLAPPING.  DWUCKY
   CALCULATION WAS MADE FOR THE FOLLOWING LEVELS TOO, AND RESULTS
   WERE ADDED TO THE CONTINUUM INELASTIC SCATTERING CROSS SECTION
   (MT=91).
                  2.0462           3/2-
                  2.2490           9/2-
                  2.4098           9/2+

MT=16, 17, 22, 28    (N,2N), (N,3N), (N,NA),(N,NP)
  ADOPTED FROM JENDL FUSION FILE.  THEORETICAL CALCULATION WAS
  MADE WITH SINCROS-II.

MT=102       CAPTURE
  CALCULATED WITH THE CASTHY CODE/10/ AND NORMALIZED TO 22 MB
  AT 45 KEV/11/.

MT=103, 107      (N,P), (N,A)
  CALCULATED WITH THE GNASH CODE/12/ USING THE OPTICAL MODEL
  PARAMETERS LISTED IN MT=1.

MT=251       MU-BAR
  CALCULATED WITH THE OPTICAL MODEL.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=2
  CALCULATED WITH THE CASTHY CODE/10/.
 MT=51-58
  TAKEN FROM JENDL FUSION FILE.  CALCULATED WITH THE CASTHY AND
  DWUCKY IN THE SINCROS-II SYSTEM.
 MT=16, 17, 22, 28, 91
  TAKEN FROM JENDL FUSION FILE, AND TRANSFORMED INTO THE LAB
  SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=16, 17, 22, 28, 91
  TAKEN FROM JENDL FUSION FILE, AND TRANSFORMED INTO THE LAB
  SYSTEM.
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REFERENCES


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 1) CHIBA, S. ET AL.: JAERI-M 92-027, P.35 (1992).
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 3) KUMABE, I. ET AL.: NUCL. SCI. ENG., 104, 280 (1990).
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MAT number = 2037

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 20-CA- 44 DEC        EVAL-MAR87 M.HATCHYA(DATA ENG. CO.)
                      DIST-SEP89 REV2-NOV93
HISTORY
87-03 NEW EVALUATION WAS MADE TO GIVE A FULL REVISION FOR JENDL-2
      DATA.
87-03 COMPILED BY T.ASAMI(NEDAC)
93-11 JENDL-3.2
       DATA WERE MAINLY ADOPTED FROM JENDL FUSION FILE.
      COMPILED BY T.NAKAGAWA

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (3,1), (3,2), (3,4), (3,16), (N,3N), (3,22), (3,28),
      (3,51-91)
      ALL ANGULAR DISTRIBUTIONS EXCEPT FOR (4,2).
      ALL ENERGY DISTRIBUTIONS.
     ***********************************************************

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      JENDL FUSION FILE /1/  (AS OF NOV. 1993)
            EVALUATED BY K.KOSAKO (NEDAC) AND S.CHIBA (NDC/JAERI)
            COMPILED  BY K.KOSAKO.

       -  THE INELASTIC SCATTERING CROSS SECTIONS AND ANGULAR
          DISTRIBUTIONS OF INELASTICALLY SCATTERED NEUTRONS (EXCEPT
          CONTINUUM INELASTIC) WERE CALCULATED WITH CASTHY2Y AND
          DWUCKY IN SINCROS-II SYSTEM/2/ INCLUDING CONTRIBUTIONS
          FROM DIRECT REACTIONS.
       -  THE (N,2N), (N,3N), (N,NA) AND (N,NP) REACTION CROSS
          SECTIONS (MT=16, 17, 22, 28) WERE CALCULATED BY EGNASH2
          IN THE SINCROS-II.
       -  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE REPLACED
          WITH THOSE CALCULATED BY EGNASH2.  THE DDX'S OF THE
          CONTINUUM NEUTRONS WERE CALCULATED BY KUMABE'S SYSTEMA-
          TICS /3/ USING F15TOB /1/.  THE PRECOMPOUND/COMPOUND
          RATIO WAS CALCULATED BY THE SINCROS-II CODE SYSTEM.
       -  THE RESONANCE PARAMETERS, TOTAL, CAPTURE, (N,P) AND (N,A)
          CROSS SECTIONS AND ANG. DISTRIBUTIONS OF ELASTICALLY
          SCATTERED NEUTRONS WERE TAKEN FROM JENDL-3.1.
       -  OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED IN
          THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./2/.
          LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/4/.
     -------------------------------------------------------------


MF=1  GENERAL INFORMATION
 MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
 MT=151  RESOLVED RESONANCE PARAMETERS
   RESOLVED PARAMETERS FOR MLBW FORMULA WERE GIVEN IN THE ENERGY
   REGION FROM 1.0E-5 EV TO 500 KEV.  PARAMETERS WERE TAKEN FROM
   THE RECOMMENDED DATA OF BNL/5/ AND THE DATA FOR A NEGATIVE
   RESONANCE WERE ADDED SO AS TO REPRODUCE THE RECOMMENDED THERMAL
   CROSS SECTIONS FOR CAPTURE AND SCATTERING/5/.  THE SCATTERING
   RADIUS WAS ASSUMED TO BE 3.6 FERMI.  CALCULATED 2200 M/SEC
   CROSS SECTIONS AND RESONANCE INTEGRALS ARE AS FOLLOWS:

           2200 M/S CROSS SECTION(B)     RES. INTEGRAL(B)
   ELASTIC      3.320
   CAPTURE      0.888                        0.4254
   TOTAL        4.208

MF=3  NEUTRON CROSS SECTIONS
   BELOW 500 KEV, ZERO BACKGROUND CROSS SECTION WAS GIVEN AND  ALL
   THE CROSS-SECTION DATA ARE REPRODUCED FROM THE EVALUATED
   RESOLVED RESONANCE PARAMETERS WITH MLBW FORMULA.

   FOR JENDL-3.2, ALL CROSS-SECTION DATA EXCEPT FOR THE TOTAL,
   CAPTURE, (N,P) AND (N,A) CROSS SECTIONS WERE ADOPTED FROM JENDL
   FUSION FILE.  THE CALCULATION WAS MADE WITH SINCROS-II SYSTEM
   /2/ BY ADOPTING WALTER-GUSS OMP MODIFIED BY YAMAMURO/2/ FOR
   NEUTRON, PEREY OMP /6/ FOR PROTON, LEMOS OMP MODIFIED BY ARTHUR
   AND YOUNG/7/ FOR ALPHA, LOHR-HAEBERLI OMP/8/ FOR DEUTERON,
   BECCHETTII-GREENLEES OMP/9/ FOR TRITON AND HE-3, AND STANDARD
   LEVEL DENSITY PARAMETERS OF SINCROS-II SYSTEM.

 MT=1 TOTAL
   OPTICAL AND STATISTICAL MODEL CALCULATION WAS MADE WITH THE
   CASTHY CODE/10/. THE OPTICAL POTENTIAL PARAMETERS USED ARE:
         V = 49.68,               VSO = 7.12   (MEV)
        WS = 7.76 - 0.5*EN,        WV = 0      (MEV)
         R = 1.17,    RS = 1.09,  RSO = 1.17   (FM)
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       A = 0.6,   ASO = 0.6,       B = 0.69   (FM)

 MT=2 ELASTIC SCATTERING
   OBTAINED BY SUBTRACTING THE SUM OF THE PARTIAL CROSS SECTIONS
   FROM THE TOTAL CROSS SECTION.

 MT=4, 51-59, 91 INELASTIC SCATTERING
   THE CROSS SECTIONS WERE TAKEN FROM JENDL FUSION FILE.  THE
   LEVEL SCHEME WAS BASED ON REF./4/  CONTRIBUTIONS OF THE DIRECT
   PROCESS WERE CALCULATED FOR THE LEVELS MARKED WITH '*' BY MEANS
   OF DWUCKY.  DEFORMATION PARAMETERS WERE ADOPTED FROM RAMAN ET
   AL./11/ AND SPEAR/12/.

         NO.      ENERGY(MEV)    SPIN-PARITY (DIRECT PROCESS)
                   0.0              0 +
         1         1.157            2 +          *
         2         1.8835           0 +
         3         2.2831           4 +          *
         4         2.6565           2 +          *
         5         3.0443           4 +          *
         6         3.2849           5 +
         7         3.3013           2 +
         8         3.3079           3 -          *
         9         3.3572           2 +
    LEVELS ABOVE 3.357 MEV WERE ASSUMED TO BE OVERLAPPING.

 MT=16, 17, 22, 28   (N,2N), (N,3N), (N,NA),(N,NP)
   ADOPTED FROM JENDL FUSION FILE.  THEORETICAL CALCULATION WAS
   MADE WITH SINCROS-II.  THE (N,NP) CROSS SECTION WAS NORMALIZED
   TO THE EXPERIMENTAL DATA OF IKEDA ET AL./13/

 MT=102      CAPTURE
   CALCULATED WITH THE CASTHY CODE/10/ AND NORMALIZED TO 7.1 MB
   AT 45 KEV/14/.

 MT=103, 107    (N,P), (N,A)
   CALCULATED WITH THE GNASH CODE/15/ USING THE SAME OPTICAL MODEL
   PARAMETERS AS THE TOTAL CROSS SECTION.

 MT=251      MU-BAR
   CALCULATED WITH THE OPTICAL MODEL.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=2
   CALCULATED WITH THE CASTHY CODE/10/.
 MT=51-58
   TAKEN FROM JENDL FUSION FILE.  CALCULATED WITH THE CASTHY AND
   DWUCKY IN THE SINCROS-II SYSTEM.
 MT=16, 17, 22, 28, 91
   TAKEN FROM JENDL FUSION FILE, AND TRANSFORMED INTO THE LAB
   SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=16, 17, 22, 28, 91
   TAKEN FROM JENDL FUSION FILE, AND TRANSFORMED INTO THE LAB
   SYSTEM.

REFERENCES
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 1) CHIBA, S. ET AL.: JAERI-M 92-027, P.35 (1992).
 2) YAMAMURO, N.: JAERI-M 90-006 (1990).
 3) KUMABE, I. ET AL.: NUCL. SCI. ENG., 104, 280 (1990).
 4) ENSDF: EVALUATED NUCLEAR STRUCTURE DATA FILE, BNL/NNDC.
 5) MUGHABGHAB S.F. AND GARBER D.I. :"NEUTRON CROSS SECTIONS",
    VOL. 1, PART B (1984).
 6) PEREY, F.G.: PHYS. REV., 131, 745 (1963).
 7) ARTHUR, E.D. AND YOUNG, P.G.: LA-8626-MS (1980).
 8) LOHR, J.M. AND HAEBERLI W.: NUCL. PHYS., A232, 381 (1974).
 9) BECCHETTI, F.D. JR. AND GREENLEES G.W.: "POLARIZATION
   PHENOMENA IN NUCL. REACTIONS," UNIV. WISCONSIN PRESS, P.682
   (1971).
10) IGARASI S. AND FUKAHORI T.: JAERI 1321 (1991).
11) RAMAN, S., ET AL.: ATOM. DATA AND NUCL. DATA TABLES 36, 1
    (1987)
12) SPEAR, R.H.: ATOM. DATA AND NUCL. DATA TABLE, 42, 55 (1989).
13) IKEDA Y. ET AL.: JAERI 1312 (1988).
14) MUSGROVE A.R.DE L. ET AL.: NUCL. PHYS., A279, 317 (1977).
15) YOUNG P.G. AND ARTHUR E.D. : LA-6947 (1977).
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MAT number = 2043
 20-CA- 46 MITSUI E.S.EVAL-APR80 M.HATCHYA
                      DIST-FEB84 REV2-NOV93
HISTORY
80-04 NEW EVALUATION WAS MADE BY M.HATCHYA (MITSUI).
83-11 ANG. DIST. WAS MODIFIED.
84-02 COMMENT WAS ADDED.
88-10 UNCHANGED FROM JENDL-2.
93-11 JENDL-3.2
        DATA WERE MAINLY ADOPTED FROM JENDL FUSION FILE.
      COMPILED BY T.NAKAGAWA

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (3,2), (3,4), (3,16), (3,17), (3,22), (3,28), (3,51-91)
      ALL ANGULAR DISTRIBUTIONS EXCEPT FOR (4,2).
      ALL ENERGY DISTRIBUTIONS.
     ***********************************************************
     -------------------------------------------------------------
      JENDL FUSION FILE /1/  (AS OF NOV. 1993)
            EVALUATED BY K.KOSAKO (NEDAC) AND S.CHIBA (NDC/JAERI)
            COMPILED  BY K.KOSAKO.

       -  THE INELASTIC SCATTERING CROSS SECTIONS AND ANGULAR
          DISTRIBUTIONS OF INELASTICALLY SCATTERED NEUTRONS (EXCEPT
          CONTINUUM INELASTIC) WERE CALCULATED WITH CASTHY2Y AND
          DWUCKY IN SINCROS-II SYSTEM/2/ INCLUDING CONTRIBUTIONS
          FROM DIRECT REACTIONS.
       -  THE (N,2N), (N,3N), (N,NA) AND (N,NP) REACTION CROSS
          SECTIONS (MT=16, 17, 22, 28) WERE CALCULATED BY EGNASH2
          IN THE SINCROS-II.
       -  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE REPLACED
          WITH THOSE CALCULATED BY EGNASH2.  THE DDX'S OF THE
          CONTINUUM NEUTRONS WERE CALCULATED BY KUMABE'S SYSTEMA-
          TICS /3/ USING F15TOB /1/.  THE PRECOMPOUND/COMPOUND
          RATIO WAS CALCULATED BY THE SINCROS-II CODE SYSTEM.
       -  THE TOTAL, CAPTURE, (N,P) AND (N,A) CROSS SECTIONS AND
          ANG. DISTRIBUTIONS OF ELASTICALLY SCATTERED NEUTRONS WERE
          TAKEN FROM JENDL-3.1.
       -  OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED IN
          THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./2/.
          LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/4/.
     -------------------------------------------------------------


MF=1  GENERAL INFORMATION
  MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
  MT=151  NO RESONANCE PARAMETERS

      2200-M/SEC CROSS SECTIONS AND CALCULATED RESONANCE INTEGRALS
                     2200-M/SEC       RES.INTEG.
         ELASTIC       2.900  B           -
         CAPTURE       0.7400 B         0.339 B
         TOTAL         3.640  B           -

MF=3  NEUTRON CROSS SECTIONS
   THERMAL REGION WAS ASSUMED BELOW 1.0 KEV.  THE CAPTURE AND
   ELASTIC SCATTERING CROSS SECTIONS WERE ASSUMED TO BE 0.74 BARNS
   /5/ AND 2.9 BARNS AT 0.0253 EV, RESPECTIVELY.  THE TOTAL CROSS
   SECTION WAS CALCULATED AS A SUM OF THESE TWO.

   FOR JENDL-3.2, ABOVE 1 KEV, ALL CROSS-SECTION DATA EXCEPT FOR
   THE TOTAL, CAPTURE, (N,P) AND (N,A) CROSS SECTIONS WERE ADOPTED
   FROM JENDL FUSION FILE.  THE CALCULATION WAS MADE WITH
   SINCROS-II SYSTEM/2/ BY ADOPTING WALTER-GUSS OMP MODIFIED BY
   YAMAMURO/2/ FOR NEUTRON, PEREY OMP /6/ FOR PROTON, LEMOS OMP
   MODIFIED BY ARTHUR AND YOUNG/7/ FOR ALPHA, LOHR-HAEBERLI OMP/8/
   FOR DEUTERON, BECCHETTII-GREENLEES OMP/9/ FOR TRITON AND HE-3,
   AND STANDARD LEVEL DENSITY PARAMETERS OF SINCROS-II SYSTEM.

 MT=1    TOTAL CROSS SECTION
   THE OPTICAL MODEL CALCULATION WITH CASTHY /10/ WAS ADOPTED.

     OPTICAL POTENTIAL PARAMETERS WERE TAKEN FROM REF./11/.
               V  = 46.72          (MEV),
               WS =  9.13          (MEV),
               VSO=  5.37          (MEV),
               R0 = RSO = 1.26     (FM),
               RS = 1.39           (FM),
               A  = ASO= 0.76      (FM),
               B  = 0.40           (FM).
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 MT=2    ELASTIC SCATTERING CROSS SECTION
   DERIVED BY SUBTRACTING PARTIAL CROSS SECTIONS FROM THE TOTAL
   CROSS SECTION.

 MT=4,51-53,91 INELASTIC SCATTERING CROSS SECTIONS
   THE CROSS SECTIONS WERE TAKEN FROM JENDL FUSION FILE.  THE
   LEVEL SCHEME WAS BASED ON REF./4/  CONTRIBUTIONS OF THE
   DIRECT PROCESS WERE CALCULATED FOR THE LEVELS MARKED WITH '*'
   BY MEANS OF DWUCKY.  DEFORMATION PARAMETERS WERE ADOPTED FROM
   RAMAN ET AL./12/ AND SPEAR/13/.

         NO.     ENERGY(MEV)    SPIN-PARITY (DIRECT PROCESS)
                 0.0               0 +
          1      1.346             2 +          *
          2      2.4231            0 +
          3      2.5747            4 +
          4      2.9739            6 +
          5      3.0226            2 +
          6      3.6140            3 -          *
          7      3.6389            2 +
          8      3.8597            4 +
     LEVELS ABOVE 3.86 MEV WERE ASSUMED TO BE OVERLAPPING.

 MT=16, 17, 22, 28   (N,2N), (N,3N), (N,NA),(N,NP)
   ADOPTED FROM JENDL FUSION FILE.  THEORETICAL CALCULATION WAS
   MADE WITH SINCROS-II.

 MT=102  CAPTURE CROSS SECTION
   CALCULATED WITH CASTHY /10/.

 MT=103,107  (N,P) AND (N,ALPHA) CROSS SECTIONS
   STATISTICAL AND PRE-EQUILIBRIUM MODEL CALCULATIONS USING THE
   OPTICAL POTENTIAL PARAMETERS FOR THE TOTAL CROSS SECTION.

 MT=251  MU-BAR
   CALCULATED WITH OPTICAL MODEL.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=2
   OPTICAL MODEL CALCULATION
 MT=51-58
   TAKEN FROM JENDL FUSION FILE.  CALCULATED WITH THE CASTHY AND
   DWUCKY IN THE SINCROS-II SYSTEM.
 MT=16, 17, 22, 28, 91
   TAKEN FROM JENDL FUSION FILE, AND TRANSFORMED INTO THE LAB
   SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=16, 17, 22, 28, 91
   TAKEN FROM JENDL FUSION FILE, AND TRANSFORMED INTO THE LAB
   SYSTEM.

REFERENCES
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 1) CHIBA, S. ET AL.: JAERI-M 92-027, P.35 (1992).
 2) YAMAMURO, N.: JAERI-M 90-006 (1990).
 3) KUMABE, I. ET AL.: NUCL. SCI. ENG., 104, 280 (1990).
 4) ENSDF: EVALUATED NUCLEAR STRUCTURE DATA FILE, BNL/NNDC.
 5) MUGHABGHAB S.F. ET AL.: NEUTRON CROSS SECTIONS, VOL. 1, PART A
    (1981).
 6) PEREY, F.G.: PHYS. REV., 131, 745 (1963).
 7) ARTHUR, E.D. AND YOUNG, P.G.: LA-8626-MS (1980).
 8) LOHR, J.M. AND HAEBERLI W.: NUCL. PHYS., A232, 381 (1974).
 9) BECCHETTI, F.D. JR. AND GREENLEES G.W.: "POLARIZATION
   PHENOMENA IN NUCL. REACTIONS," UNIV. WISCONSIN PRESS, P.682
   (1971).
10) IGARASI S. AND FUKAHORI T.: JAERI 1321 (1991).
11) FU C.Y.: ATOMIC DATA AND NUCLEAR DATA TABLE 17, 127 (1976).
12) RAMAN, S., ET AL.: ATOM. DATA AND NUCL. DATA TABLES 36, 1
    (1987)
13) SPEAR, R.H.: ATOM. DATA AND NUCL. DATA TABLE, 42, 55 (1989).
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MAT number = 2049
 20-CA- 48 DEC          EVAL-MAR87 M.HATCHYA(DATA ENG. CO.)
                        DIST-SEP89 REV2-NOV93
HISTORY
87-03 NEW EVALUATION WAS MADE TO GIVE A FULL REVISION FOR JENDL-2
      DATA.
87-03 COMPILED BY T.ASAMI(NEDAC)
93-11 JENDL-3.2
       DATA WERE MAINLY ADOPTED FROM JENDL FUSION FILE.
      COMPILED BY T.NAKAGAWA

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (3,1), (3,2), (3,4), (3,16), (3,17), (3,28), (3,51-91),
      (3,103).
           (3,22), (3:53-58): DELETED
      ALL ANGULAR DISTRIBUTIONS EXCEPT FOR (4,2).
      ALL ENERGY DISTRIBUTIONS.
     ***********************************************************
     -------------------------------------------------------------
      JENDL FUSION FILE /1/  (AS OF NOV. 1993)
            EVALUATED BY K.KOSAKO (NEDAC) AND S.CHIBA (NDC/JAERI)
            COMPILED  BY K.KOSAKO.

      -  THE INELASTIC SCATTERING CROSS SECTIONS AND ANGULAR
         DISTRIBUTIONS OF INELASTICALLY SCATTERED NEUTRONS (EXCEPT
         CONTINUUM INELASTIC) WERE CALCULATED WITH CASTHY2Y AND
         DWUCKY IN SINCROS-II SYSTEM/2/ INCLUDING CONTRIBUTIONS
         FROM DIRECT REACTIONS.
      -  THE (N,2N), (N,3N) AND (N,NP) REACTION CROSS SECTIONS
         (MT=16, 17, 28) WERE CALCULATED BY EGNASH2 IN THE
         SINCROS-II.
      -  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE REPLACED
         WITH THOSE CALCULATED BY EGNASH2.  THE DDX'S OF THE
         CONTINUUM NEUTRONS WERE CALCULATED BY KUMABE'S SYSTEMA-
         TICS /3/ USING F15TOB /1/.  THE PRECOMPOUND/COMPOUND
         RATIO WAS CALCULATED BY THE SINCROS-II CODE SYSTEM.
      -  THE RESONANCE PARAMETERS, TOTAL, CAPTURE, (N,P) AND (N,A)
         CROSS SECTIONS AND ANG. DISTRIBUTIONS OF ELASTICALLY
         SCATTERED NEUTRONS WERE TAKEN FROM JENDL-3.1.
      -  OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED IN
         THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./2/.
         LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/4/.
     -------------------------------------------------------------


MF=1  GENERAL INFORMATION
 MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
 MT=151  RESOLVED RESONANCE PARAMETERS
   RESOLVED PARAMETERS FOR MLBW FORMULA WERE GIVEN IN THE ENERGY
   REGION FROM 1.0E-5 EV TO 500 KEV.  PARAMETERS WERE TAKEN FROM
   THE RECOMMENDED DATA OF BNL/5/ AND THE DATA FOR A NEGATIVE
   RESONANCE WERE ADDED SO AS TO REPRODUCE THE RECOMMENDED THERMAL
   CROSS SECTIONS FOR CAPTURE AND SCATTERING/5/.  THE SCATTERING
   RADIUS WAS ASSUMED TO BE 3.6 FERMI.  CALCULATED 2200 M/SEC
   CROSS SECTIONS AND RESONANCE INTEGRALS ARE AS FOLLOWS:

           2200 M/S CROSS SECTION(B)     RES. INTEGRAL(B)
   ELASTIC       3.717
   CAPTURE       1.092                        0.4859
   TOTAL         4.809

MF=3  NEUTRON CROSS SECTIONS
   BELOW 500 KEV, ZERO BACKGROUND CROSS SECTION WAS GIVEN AND ALL
   THE CROSS-SECTION DATA ARE REPRODUCED FROM THE EVALUATED
   RESOLVED RESONANCE PARAMETERS WITH MLBW FORMULA.

   FOR JENDL-3.2, ALL CROSS-SECTION DATA EXCEPT FOR THE TOTAL,
   CAPTURE, (N,P) AND (N,A) CROSS SECTIONS WERE ADOPTED FROM JENDL
   FUSION FILE.  THE CALCULATION WAS MADE WITH SINCROS-II SYSTEM
   /2/ BY ADOPTING WALTER-GUSS OMP MODIFIED BY YAMAMURO/2/ FOR
   NEUTRON, PEREY OMP /6/ FOR PROTON, LEMOS OMP MODIFIED BY ARTHUR
   AND YOUNG/7/ FOR ALPHA, LOHR-HAEBERLI OMP/8/ FOR DEUTERON,
   BECCHETTII-GREENLEES OMP/9/ FOR TRITON AND HE-3, AND STANDARD
   LEVEL DENSITY PARAMETERS OF SINCROS-II SYSTEM.

 MT=1 TOTAL
   OPTICAL AND STATISTICAL MODEL CALCULATION WAS MADE WITH THE
   CASTHY CODE/10/. THE OPTICAL POTENTIAL PARAMETERS USED ARE:
         V = 49.68,                VSO = 7.12   (MEV)
        WS = 7.76 - 0.5*EN,         WV = 0      (MEV)
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        R = 1.17,   RS = 1.09,    RSO = 1.17   (FM)
        A = 0.6,   ASO = 0.6,       B = 0.69   (FM)
  THE SHAPE OF THE TOTAL CROSS SECTION WAS SLIGHTLY MODIFIED
  FOR JENDL-3.2.

 MT=2 ELASTIC SCATTERING
  OBTAINED BY SUBTRACTING THE SUM OF THE PARTIAL CROSS SECTIONS
  FROM THE TOTAL CROSS SECTION.

 MT=4, 51-52, 91 INELASTIC SCATTERING
  THE CROSS SECTIONS WERE TAKEN FROM JENDL FUSION FILE.  THE
  LEVEL SCHEME WAS BASED ON REF./4/  CONTRIBUTIONS OF THE DIRECT
  PROCESS WERE CALCULATED FOR THE LEVELS MARKED WITH '*' BY MEANS
  OF DWUCKY.  DEFORMATION PARAMETERS WERE ADOPTED FROM RAMAN ET
  AL./11/ AND SPEAR/12/.

        NO.     ENERGY(MEV)    SPIN-PARITY (DIRECT PROCESS)
                 0.0              0 +
         1       3.8317           2 +          *
         2       4.2842           0 +
  LEVELS ABOVE 4.284 MEV WERE ASSUMED TO BE OVERLAPPING.  THE
  LEVELS FOR MTS=53 TO 58 GIVEN IN JENDL-3.1 WERE NOT CONSIDERED
  IN JENDL FUSION FILE.  THE DIRECT INELSTIC CROSS SECTION TO THE
  LEVELS AT 4.507 MEV WAS CALCULATED WITH DWUCKY AND ADDED TO THE
  CONTINUUM INELASTIC CROSS SECTION (MT=91).

 MT=16, 17, 28   (N,2N), (N,3N), (N,NP)
  ADOPTED FROM JENDL FUSION FILE.  THEORETICAL CALCULATION WAS
  MADE WITH SINCROS-II.  THE (N,2N) CROSS SECTION WAS NORMALIZED
  TO THE EXPERIMENTAL DATA OF IKEDA ET AL./13/ (0.759 B AT 13.99
  MEV)

 MT=103, 107    (N,P), (N,A)
  CALCULATED WITH THE GNASH CODE/14/ USING THE OPTICAL MODEL
  PARAMETERS LISTED AT MT=1.  THE (N,P) CROSS SECTIONS WERE
  NORMALIZED TO THE EXPERIMENTAL DATA OF TIWARI ET AL./15/ AT
  14.5 MEV. THE SHAPE OF (N,P) CROSS SECTION AROUND THE THRESHOLD
  ENERGY WAS CHANGED FOR JENDL-3.2.

 MT=102      CAPTURE
  CALCULATED WITH THE CASTHY CODE/10/ AND NORMALIZED TO 1.05 MB
  AT 30 KEV/16/.

 MT=251      MU-BAR
  CALCULATED WITH THE OPTICAL MODEL.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=2
  CALCULATED WITH THE CASTHY CODE/10/.
 MT=51-52
  TAKEN FROM JENDL FUSION FILE.  CALCULATED WITH THE CASTHY AND
  DWUCKY IN THE SINCROS-II SYSTEM.
 MT=16, 17, 28, 91
  TAKEN FROM JENDL FUSION FILE, AND TRANSFORMED INTO THE LAB
  SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=16, 17, 28, 91
  TAKEN FROM JENDL FUSION FILE, AND TRANSFORMED INTO THE LAB
  SYSTEM.
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 1) CHIBA, S. ET AL.: JAERI-M 92-027, P.35 (1992).
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    VOL. 1, PART B (1984).
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MAT number = 2125
 21-SC- 45 KHI          EVAL-AUG88 T.WATANABE
                        DIST-SEP89 REV2-SEP93
HISTORY
88-08  JENDL-2 MODIFIED BY T.WATANABE
                            (KAWASAKI HEAVY INDUSTRIES, LTD.)
93-09  JENDL-3.2.
       COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)              PARAMETERS OF 3.295-KEV RESONANCE
      (3,2), (3,102)
     ***********************************************************

MF=1    GENERAL INFORMATION
  MT=451   DESCRIPTIVE DATA AND DICTIONARY

MF=2
  MT=151   RESONANCE PARAMETERS            : 1.0E-5 EV - 100 KEV
        RESOLVED RESONANCES FOR MLBW FORMULA:
           PARAMETERS WERE EVALUATED BASED ON EXPERIMENTAL DATA
           /1/,/2/,/3/ AND MODIFIED TO REPRODUCE EXPERIMENTAL
           TOTAL CROSS SECTIONS. NEGATIVE ENERGY LEVELS WERE ADDED
           TO REPRODUCE THE TOTAL AND CAPTURE CROSS SECTIONS/4/ AT
           THERMAL AND THE TOTAL CROSS SECTION /5/ AT 2 KEV.  FOR
           JENDL-3.2, CAPTURE WIDTH OF 3.295-KEV RESONANCE WAS
           CHANGED TO 0.71 EV/4/.

        CALCULATED 2200 M/S CROSS SECTIONS AND RESONANCE INTEGRALS
                         2200 M/SEC        RES. INTEG.
            ELASTIC        22.48 B            -
            CAPTURE        27.14 B           11.85 B
            TOTAL          49.62 B            -

MF=3    NEUTRON CROSS SECTIONS                      : ABOVE 100 KEV
  MT=1,2,4,51-74,91,102  TOTAL, ELASTIC, INELASTIC AND CAPTURE
           CALCULATED WITH OPTICAL AND STATISTICAL MODEL.  DIRECT
           INELASTIC REACTION CROSS SECTIONS WERE EVALUATED WITH
           DWBA /6/ AND ADDED TO COMPOUND PROCESSES.  STATISTICAL
           MODEL CALCULATION WITH CASTHY CODE /7/ WAS PERFORMED.
           MT=102 CAPTURE CROSS SECTION WAS NORMALIZED TO THE
           EXPERIMENTAL DATA OF VOIGNIER+/8/, 11.2 MB AT 500 KEV.
           DIRECT CAPTURE CROSS SECTION WAS CALCULATED FROM A
           SIMPLE FORMULA OF BENZI AND REFFO/9/ AND NORMALIZED TO
           1.0 MB AT 14.0 MEV.

        THE SPHERICAL OPTICAL POTENTIAL PARAMETERS WERE EVALUATED
           TO REPRODUCE TOTAL EXPERIMENTAL CROSS SECTIONS
           /10,11,12/.
           V = 56.2 - 0.3244*EN  MEV  R0= 1.155 FM  A0= 0.666 FM
           WS= 8.638-0.003093*EN MEV  RS= 1.473 FM  B = 0.262 FM
           VSO=5.254 MEV              RSO=1.003 FM  ASO=0.485 FM

        THE LEVEL SCHEME TAKEN FROM REF./13/:
           NO.         ENERGY(MEV)   SPIN-PARITY     BETA
           G.S         0.0             7/2-
            1          0.012396        3/2+
            2          0.37659         3/2-          0.108
            3          0.543           5/2+
            4          0.72017         5/2-          0.0867
            5          0.9392          1/2+          0.0211
            6          0.97461         7/2+
            7          1.0672          3/2-          0.0586
            8          1.23723        11/2-          0.143
            9          1.30342         3/2+
           10          1.40887         7/2-
           11          1.43367         9/2+
           12          1.5564          3/2-
           13          1.66231         9/2-          0.0843
           14          1.8004          5/2+

        CONTINUUM LEVELS ASSUMED ABOVE 1.9 MEV
           LEVEL DENSITY PARAMETERS WERE EVALUATED USING D0/4/,
           AND LEVEL DATA /13/.
                       A          T          EX          SIG**2(0)
           21-SC-45    7.855      1.282     10.08        7.602
           21-SC-46    7.231      1.268      7.328       7.867

  MT=16  (N,2N)
           THE JENDL-2 DATA WERE MODIFIED BY USING EXPERIMENTAL
           DATA /14/.
  MT=103 (N,P)
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          TAKEN FROM COMPILATION BY ALLEY AND LESSLER /15/
  MT=107 (N,ALPHA)
          SAME AS MT=103, BUT SLIGHTLY MODIFIED TO REPRODUCE
          EXPERIMENTAL DATA/14/.
  MT=251 MU-BAR
          CALCULATED FROM THE DATA IN MF=4.

MF=4    ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2     CALCULATED WITH OPTICAL MODEL.
  MT=51-91 CALCULATED WITH HAUSER-FESHBACH FORMULA ADDED WITH
          DIRECT REACTION.
  MT=16    ISOTROPIC IN THE LABORATORY SYSTEM

MF=5    ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
          CALCULATED WITH SINCROS /16/.
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    ACADEMIC PRESS (1981)
 5) FUJITA, Y: J. NUCL. SCI. TECHNOL. 20, 191 (1983).
 6) KUNZ, P.D.: UNPUBLISHED (1974).
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    TAKEN FROM EXFOR
 9) BENZI, V. AND REFFO, G.: CCDN-NW/10 (1969).
10) POENITZ, W.P. AND WHALEN, J.F.: ANL/NDM-80 (1983).
11) BARNARD, E. ET AL.: Z. PHYS. 245, 36 (1971).
12) FOSTER, JR. D.G. AND GLASGOW D.W.: PHYS. REV. C3, 576 (1971).
13) BURROWS, T.W.: NUCLEAR DATA SHEETS 40, 216 (1983).
14) IKEDA, Y., ET AL.: JAERI 1312 (1988).
15) ALLEY, W.E. AND LESSLER, R.M: NUCLEAR DATA TABLES A11,648
    (1973).
16) YAMAMURO, N.: JAERI-M 88-140 (1988).
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MAT number = 2200

```
 22-TI-  0 KUR       EVAL-SEP88 K.KOBAYASHI(KUR),H.HASHIKURA(TOK)
                     DIST-SEP89 REV2-FEB94
HISTORY
88-09 COMPILED BY T.ASAMI(NEDAC)
94-02 JENDL-3.2
      DATA WERE MAINLY ADOPTED FROM JENDL FUSION FILE.
      GAMMA-RAY PRODUCTION DATA WERE REVISED BY T.ASAMI(DATA ENG.)
      COMPILED BY T.NAKAGAWA

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      ALL CROSS SECTIONS EXCEPT (3,1), (3,102) AND (3,107)
      ALL ANGULAR DISTRIBUTIONS EXCEPT FOR (4,2).
      ALL ENERGY DISTRIBUTIONS.
     (12,102), (13,4), (15,102)
     ***********************************************************
     -------------------------------------------------------------
      JENDL FUSION FILE /1/  (AS OF FEB. 1994)
            EVALUATED BY K.KOSAKO (NEDAC) AND S. CHIBA (NDC/JAERI)
            COMPILED  BY K.KOSAKO.

      -  THE INELASTIC SCATTERING CROSS SECTIONS AND ANGULAR
         DISTRIBUTIONS OF INELASTICALLY SCATTERED NEUTRONS (EXCEPT
         CONTINUUM INELASTIC) WERE CALCULATED WITH CASTHY2Y AND
         DWUCKY IN SINCROS-II SYSTEM/2/ INCLUDING CONTRIBUTIONS
         FROM DIRECT REACTIONS.
      -  THE (N,2N), (N,NA), (N,NP) AND (N,P) REACTION CROSS
         SECTIONS (MT=16, 22, 28, 103) WERE CALCULATED BY EGNASH2
         IN THE SINCROS-II.
      -  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE REPLACED
         BY THOSE CALCULATED BY EGNASH2.  THE DDX'S OF THE
         CONTINUUM NEUTRONS WERE CALCULATED BY KUMABE'S SYSTEMA-
         TICS /3/ USING F15TOB /1/.  THE PRECOMPOUND/COMPOUND
         RATIO WAS CALCULATED BY THE SINCROS-II CODE SYSTEM.
      -  THE RESONANCE PARAMETERS, TOTAL, CAPTURE AND (N,A) CROSS
         SECTIONS AND ANG. DISTRIBUTIONS OF ELASTICALLY SCATTERED
         NEUTRONS WERE TAKEN FROM JENDL-3.1.
      -  OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED IN
         THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./2/.
         LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/4/.
     -------------------------------------------------------------


MF=1  GENERAL INFORMATION
 MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
 MT=151  RESOLVED RESONANCE PARAMETERS
   RESOLVED PARAMETERS FOR MLBW FORMULA WERE GIVEN IN THE ENERGY
   REGION FROM 1.0E-5 EV TO 100 KEV.  PARAMETERS WERE CONSTRUCTED
   WITH THE EVALUATED DATA FOR TI-46, -47, -48, -49 AND -50 OF TI
   STABLE ISOTOPES, CONSIDERING THEIR ABUNDANCES IN THE TI
   ELEMENT. THE ABUNDANCE DATA WERE TAKEN FROM REF./5/.

            2200 M/S CROSS SECTION(B)     RES. INTEGRAL(B)
    ELASTIC            4.087
    CAPTURE            6.092                   2.92
    TOTAL              10.18

MF=3  NEUTRON CROSS SECTIONS
   BELOW 100 KEV, NO BACKGROUND CROSS SECTION WAS GIVEN.

   ALL THE CROSS-SECTION DATA WERE DEDUCED FROM THE EVALUATED ONES
   FOR FIVE STABLE ISOTOPES OF TI CONSIDERING THEIR ABUNDANCES IN
   THE TI ELEMENT, EXCEPT FOR THE TOTAL CROSS SECTONS IN THE
   ENERGY RANGE ABOVE 100 KEV.

 MT=1 TOTAL
   THE DATA AT THE ENERGIES ABOVE 100 KEV WERE EVALUATED BASED ON
   THE EXPERIMENTAL ONES/6,7,8/, FOLLOWING FINE STRUCTURES IN
   THE MEASURED CROSS SECTIONS. THE DATA IN THE OTHER ENERGY RANGE
   WERE CONSTRUCTED FROM THE EVALUATED ONES FOR FIVE ISOTOPES OF
   TI.

 MT=2 ELASTIC SCATTERING
   OBTAINED BY SUBTRACTING THE SUM OF THE PARTIAL CROSS SECTIONS
   FROM THE TOTAL CROSS SECTION.

 MT=4, 51-87, 91 INELASTIC SCATTERING
   THE CROSS SECTIONS WERE TAKEN FROM JENDL FUSION FILE.  THE
   LEVEL SCHEME WAS BASED ON REF./4/ THE DISCRETE LEVELS WERE
   LUMPED AS BELOW:
```

MT	LEVEL ENERGY(MEV)	TI-46	TI-47	TI-48	TI-49	TI-50
G.S.	0.0					
51	0.1594		51			
52	0.8893	51				
53	0.9835			51		
54	1.2521		52,53			
55	1.3818				51	
56	1.4442		54			
57	1.5421		55		52	
58	1.5538					51
59	1.5860		56		53,54	
60	1.7235		57,58		55,56	
61	2.0098	52				
62	2.1630		59,60			
63	2.2595		61		57	
64	2.2956		62	52		
65	2.3440		63,64			
66	2.4062		65,66	53	58	
67	2.5044				59-62	
68	2.6112	53			63	52
69	2.7201				64,65	
70	2.9620	54				
71	3.0585	55				
72	3.1682	56				53
73	3.2133	57,58		55,56		
74	3.2990	59				
75	3.3332			57-59		
76	3.5085			60		
77	3.6168			61,62		
78	3.6994			63,64		
79	3.7386			65		
80	3.7710			66		54
81	3.8028			67		
82	3.8522			68		55
83	3.9748					56
84	4.1473					57
85	4.1718					58,59
86	4.3110					60
87	4.4105					61

THE THRESHOLD ENERGY FOR THE CONTINUUM OF INELASTIC SCATTERING
WAS SET TO BE 2.416 MEV.

MT=16, 22, 28, 103 (N,2N), (N,NA),(N,NP), (N,P)
ADOPTED FROM JENDL FUSION FILE. THEORETICAL CALCULATION WAS
MADE FOR EACH ISOTOPE WITH SINCROS-II. THE RESULTS WERE
NORMALIZED TO EXPERIMENTAL DATA (SEE COMMENT OF EACH ISOTOPE).

MT=102 CAPTURE
COMPOSED FROM THE ISOTOPIC DATA CALCULATED WITH THE CASTHY
CODE/9/. Q-VALUE IS A MEAN VALUE OF THOSE OF ISOTOPES.

MT=107 (N,A)
COMPOSED FROM THE ISOTOPIC DATA.

MT=251 MU-BAR
CALCULATED BASED ON OPTICAL MODEL.

MF=4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=2
CALCULATED WITH THE CASTHY CODE/9/.
MT=51-87
TAKEN FROM JENDL FUSION FILE WHICH WAS CONSTRUCTED FROM THE
ISOTOPIC DATA BY SUMMING UP THE DATA AS SHOWN IN THE TABLE OF
INELASTIC SCATTERING CROSS SECTIONS.
MT=16, 22, 28, 91
TAKEN FROM JENDL FUSION FILE.

MF=5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=16, 22, 28, 91
TAKEN FROM JENDL FUSION FILE.

MF=12 PHOTON PRODUCTION MULTIPLICITIES
MT=102 (BELOW 2.5 MEV)
FROM ENERGY BALANCE.

MF=13 PHOTON PRODUCTION CROSS SECTIONS
MT=3 (ABOVE 2.5 MEV)
BASED ON THE CLCULATION WITH THE GNASH CODE/10/, AND THE
MEASUREMENTS BY MORGAN ET AL./11/
MT=4 (BELOW 2.5 MEV)
CALCULATED FROM GAMMA-RAY TRANSITION PROBABILITIES AND CROSS

```
    SECTIONS OF ISOTOPES.

MF=14  PHOTON ANGULAR DISTRIBUTIONS
 MT=3, 4, 102
    ASSUMED TO BE ISOTROPIC IN THE LABORATORY SYSTEM.

MF=15  CONTINUOUS PHOTON ENERGY SPECTRA
 MT=3 (ABOVE 2.5 MEV)
    CALCULATED WITH THE GNASH CODE/10/.
 MT=102 (BELOW 2.5 MEV)
    CALCULATED WITH THE GNASH CODE/10/ EXCEPT FOR THERMAL WHERE
    THE SPECTRA WERE CALCULATED WITH CASTHY/9/.
```

REFERENCES


```
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 2) YAMAMURO, N.: JAERI-M 90-006 (1990).
 3) KUMABE, I. ET AL.: NUCL. SCI. ENG., 104, 280 (1990).
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10) YOUNG, P.G. AND ARTHUR, E.D.: LA-6947 (1977).
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MAT number = 2225

```
 22-TI- 46 KUR          EVAL-SEP88 K.KOBAYASHI(KUR),H.HASHIKURA(TOK)
                        DIST-SEP89 REV2-NOV93
HISTORY
88-09  COMPILED BY T.ASAMI(NEDAC)
93-11 JENDL-3.2
       DATA WERE ADOPTED FROM JENDL FUSION FILE.
      COMPILED BY T.NAKAGAWA

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      ALL CROSS SECTIONS EXCEPT (3,1), (3,102) AND (3,107)
      ALL ANGULAR DISTRIBUTIONS EXCEPT FOR (4,2).
      ALL ENERGY DISTRIBUTIONS.
     ***********************************************************
     -------------------------------------------------------------
      JENDL FUSION FILE /1/  (AS OF NOV. 1993)
            EVALUATED BY K.KOSAKO (NEDAC) AND S. CHIBA (NDC/JAERI)
            COMPILED  BY K.KOSAKO.

      -  THE INELASTIC SCATTERING CROSS SECTIONS AND ANGULAR
         DISTRIBUTIONS OF INELASTICALLY SCATTERED NEUTRONS (EXCEPT
         CONTINUUM INELASTIC) WERE CALCULATED WITH CASTHY2Y AND
         DWUCKY IN SINCROS-II SYSTEM/2/ INCLUDING CONTRIBUTIONS
         FROM DIRECT REACTIONS.
      -  THE (N,2N), (N,NA), (N,NP) AND (N,P) REACTION CROSS
         SECTIONS (MT=16, 22, 28, 103) WERE CALCULATED BY EGNASH2
         IN THE SINCROS-II.
      -  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE REPLACED
         BY THOSE CALCULATED BY EGNASH2.  THE DDX'S OF THE
         CONTINUUM NEUTRONS WERE CALCULATED BY KUMABE'S SYSTEMA-
         TICS /3/ USING F15TOB /1/.  THE PRECOMPOUND/COMPOUND
         RATIO WAS CALCULATED BY THE SINCROS-II CODE SYSTEM.
      -  THE RESONANCE PARAMETERS, TOTAL, CAPTURE AND (N,A) CROSS
         SECTIONS AND ANG. DISTRIBUTIONS OF ELASTICALLY SCATTERED
         NEUTRONS WERE TAKEN FROM JENDL-3.1.
      -  OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED IN
         THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./2/.
         LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/4/.
     -------------------------------------------------------------


MF=1  GENERAL INFORMATION
 MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
 MT=151  RESOLVED RESONANCE PARAMETERS
    RESOLVED PARAMETERS FOR MLBW FORMULA WERE GIVEN IN THE ENERGY
    REGION FROM 1.0E-5 EV TO 180 KEV.  PARAMETERS WERE TAKEN FROM
    REF./5/, FOR POSITIVE RESONANCES.  PARAMETERS FOR NEGATIVE
    RESONANCE WERE OBTAINED SO THAT THE REPRODUCED CROSS SECTIONS
    FOR BOTH SCATTERING AND CAPTURE GAVE THE 2200 M/S VALUES OF
    2.78+-0.24 AND 0.59+-0.18 BARN, RESPECTIVELY/5/.  THE SCATTER-
    ING RADIUS WAS ASSUMED TO BE 4.5 FERMI INSTEAD OF 3.5 FERMI IN
    REF./5/.  CALCULATED 2200 M/SEC CROSS SECTIONS AND RESONANCE
    INTEGRALS ARE AS FOLLOWS:

            2200 M/S CROSS SECTION(B)     RES. INTEGRAL(B)
    ELASTIC        2.75
    CAPTURE        0.596                        0.35
    TOTAL          3.34

MF=3  NEUTRON CROSS SECTIONS
  BELOW 180 KEV, NO BACKGROUND CROSS SECTION WAS GIVEN.

  FOR JENDL-3.2, ALL CROSS SECTION DATA EXCEPT FOR THE TOTAL,
  CAPTURE AND (N,A) WERE ADOPTED FROM JENDL FUSION FILE.  THE
  CALCULATION WAS MADE WITH SINCROS-II SYSTEM/2/ BY ADOPTING
  WALTER-GUSS OMP MODIFIED BY YAMAMURO/2/ FOR NEUTRON, PEREY OMP
  /6/ FOR PROTON, LEMOS OMP MODIFIED BY ARTHUR AND YOUNG/7/
  FOR ALPHA, LOHR-HAEBERLI OMP/8/ FOR DEUTERON, BECCHETTII-
  GREENLEES OMP/9/ FOR TRITON AND HE-3, AND STANDARD LEVEL
  DENSITY PARAMETERS OF SINCROS-II SYSTEM.

 MT=1 TOTAL
    OPTICAL AND STATISTICAL MODEL CALCULATION WAS MADE WITH THE
    CASTHY CODE/10/. THE OPTICAL POTENTIAL PARAMETERS USED ARE:
          V = 50.75 - 0.120*EN,    VSO = 4.72    (MEV)
         WS = 10.9 - 0.234*EN,      WV = 0.0     (MEV)
          R = 1.26,    RS = 1.02,  RSO = 1.16     (FM)
          A = 0.52,  ASO = 0.52,     B = 0.40     (FM)

 MT=2 ELASTIC SCATTERING
```

OBTAINED BY SUBTRACTING THE SUM OF THE PARTIAL CROSS SECTIONS FROM THE TOTAL CROSS SECTION.

MT=4, 51-59, 91 INELASTIC SCATTERING
THE CROSS SECTIONS WERE TAKEN FROM JENDL FUSION FILE. THE LEVEL SCHEME WAS BASED ON REF./4/ CONTRIBUTIONS OF THE DIRECT PROCESS WERE CALCULATED FOR THE LEVELS MARKED WITH '*' USING DEFORMATION PARAMETERS COMPILED BY RAMAN ET AL./11/ AND SPEAR/12/.

NO.	ENERGY(MEV)	SPIN-PARITY	(DIRECT PROCESS)
G.S.	0.0	0+	
1	0.8893	2+	*
2	2.0098	4+	*
3	2.6112	0+	
4	2.962	2+	*
5	3.0585	3-	*
6	3.1682	1-	
7	3.2133	0+	
8	3.2358	2+	*
9	3.299	6+	

LEVELS ABOVE 3.299 MEV WERE ASSUMED TO BE OVERLAPPING.

MT=16, 22, 28, 103 (N,2N), (N,NA),(N,NP), (N,P)
ADOPTED FROM JENDL FUSION FILE. THEORETICAL CALCULATION WAS MADE WITH SINCROS-II. THE RESULTS WERE NORMALIZED TO

(N,2N) 0.0549 B AT 15.01 MEV MEASURED BY IKEDA ET AL./13/
(N,P) 0.210 B AT 14.91 MEV MEASURED BY IKEDA ET AL./13/

MT=102 CAPTURE
CALCULATED WITH THE CASTHY CODE/10/ AND NORMALIZED TO 26.9 MB AT 30 KEV.

MT=107 (N,A)
CALCULATED WITH GNASH CODE/14/.

MT=251 MU-BAR
CALCULATED WITH OPTICAL MODEL.

MF=4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=2
CALCULATED WITH THE CASTHY CODE/10/
MT=16, 22, 28, 51-59, 91
TAKEN FROM JENDL FUSION FILE. THE DATA OF MT=16, 22, 28 AND 91 WERE TRANSFORMED INTO THE LAB SYSTEM.

MF=5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=16, 22, 28, 91
TAKEN FROM JENDL FUSION FILE. THE DATA WERE TRANSFORMED INTO THE LAB SYSTEM.

REFERENCES

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2) YAMAMURO, N.: JAERI-M 90-006 (1990).
3) KUMABE, I. ET AL.: NUCL. SCI. ENG., 104, 280 (1990).
4) ENSDF: EVALUATED NUCLEAR STRUCTURE DATA FILE, BNL/NNDC.
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6) PEREY, F.G.: PHYS. REV., 131, 745 (1963).
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9) BECCHETTI, F.D. JR. AND GREENLEES G.W.: "POLARIZATION PHENOMENA IN NUCL. REACTIONS," UNIV. WISCONSIN PRESS, P.682 (1971).
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13) IKEDA, Y. ET AL.: JAERI 1312 (1988).
14) YOUNG, P.G. AND ARTHUR, E.D. : LA-6947 (1977).

MAT number = 2228

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 22-TI- 47 KUR         EVAL-SEP88 K.KOBAYASHI(KUR),H.HASHIKURA(TOK)
                       DIST-SEP89 REV2-DEC93
HISTORY
88-09  COMPILED BY T.ASAMI(NEDAC)
93-12 JENDL-3.2
       DATA WERE ADOPTED FROM JENDL FUSION FILE.
      COMPILED BY T.NAKAGAWA

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      ALL CROSS SECTIONS EXCEPT (3,1), (3,102) AND (3,107)
      ALL ANGULAR DISTRIBUTIONS EXCEPT FOR (4,2).
      ALL ENERGY DISTRIBUTIONS.
     ***********************************************************
     -------------------------------------------------------------
      JENDL FUSION FILE /1/  (AS OF DEC. 1993)
            EVALUATED BY K.KOSAKO (NEDAC) AND S. CHIBA (NDC/JAERI)
            COMPILED  BY K.KOSAKO.

      -  THE INELASTIC SCATTERING CROSS SECTIONS AND ANGULAR
         DISTRIBUTIONS OF INELASTICALLY SCATTERED NEUTRONS (EXCEPT
         CONTINUUM INELASTIC) WERE CALCULATED WITH CASTHY2Y AND
         DWUCKY IN SINCROS-II SYSTEM/2/ INCLUDING CONTRIBUTIONS
         FROM DIRECT REACTIONS.
      -  THE (N,2N), (N,NA), (N,NP) AND (N,P) REACTION CROSS
         SECTIONS (MT=16, 22, 28, 103) WERE CALCULATED BY EGNASH2
         IN THE SINCROS-II.
      -  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE REPLACED
         BY THOSE CALCULATED BY EGNASH2.  THE DDX'S OF THE
         CONTINUUM NEUTRONS WERE CALCULATED BY KUMABE'S SYSTEMA-
         TICS /3/ USING F15TOB /1/.  THE PRECOMPOUND/COMPOUND
         RATIO WAS CALCULATED BY THE SINCROS-II CODE SYSTEM.
      -  THE RESONANCE PARAMETERS, TOTAL, CAPTURE AND (N,A) CROSS
         SECTIONS AND ANG. DISTRIBUTIONS OF ELASTICALLY SCATTERED
         NEUTRONS WERE TAKEN FROM JENDL-3.1.
      -  OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED IN
         THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./2/.
         LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/4/.
     -------------------------------------------------------------


MF=1  GENERAL INFORMATION
 MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
 MT=151  RESOLVED RESONANCE PARAMETERS
   RESOLVED PARAMETERS FOR MLBW FORMULA WERE GIVEN IN THE ENERGY
   REGION FROM 1.0E-5 EV TO 100 KEV.  PARAMETERS WERE TAKEN FROM
   REF./5/, FOR POSITIVE RESONANCES.  PARAMETERS FOR NEGATIVE
   RESONANCE WERE OBTAINED SO THAT THE REPRODUCED CROSS SECTIONS
   FOR BOTH SCATTERING AND CAPTURE GAVE THE 2200 M/S VALUES OF
   3.1+-0.2 AND 1.7+-0.2 BARNS, RESPECTIVELY/5/.  THE SCATTERING
   RADIUS WAS ASSUMED TO BE 4.5 FERMI INSTEAD OF 3.6 FERMI IN
   REF./5/.  CALCULATED 2200 M/SEC CROSS SECTIONS AND RESONANCE
   INTEGRALS ARE AS FOLLOWS:

            2200 M/S CROSS SECTION(B)     RES. INTEGRAL(B)
    ELASTIC       3.10
    CAPTURE       1.70                        1.44
    TOTAL         4.80

MF=3  NEUTRON CROSS SECTIONS
   BELOW 100 KEV, NO BACKGROUND CROSS SECTION WAS GIVEN.

  FOR JENDL-3.2, ALL CROSS-SECTION DATA EXCEPT FOR THE TOTAL,
  CAPTURE AND (N,A) WERE ADOPTED FROM JENDL FUSION FILE.  THE
  CALCULATION WAS MADE WITH SINCROS-II SYSTEM/2/ BY ADOPTING
  WALTER-GUSS OMP MODIFIED BY YAMAMURO/2/ FOR NEUTRON, PEREY OMP
  /6/ FOR PROTON, LEMOS OMP MODIFIED BY ARTHUR AND YOUNG/7/ FOR
  ALPHA, LOHR-HAEBERLI OMP/8/ FOR DEUTERON, BECCHETTI-GREENLEES
  OMP/9/ FOR TRITON AND HE-3, AND STANDARD LEVEL DENSITY
  PARAMETERS OF SINCROS-II SYSTEM.

 MT=1 TOTAL
   OPTICAL AND STATISTICAL MODEL CALCULATION WAS MADE WITH
   CASTHY CODE/10/. THE OPTICAL POTENTIAL PARAMETERS USED ARE:
        V = 50.75 - 0.120*EN,    VSO = 4.72   (MEV)
       WS = 10.9 - 0.234*EN,      WV = 0.0    (MEV)
        R = 1.26,   RS = 1.02,   RSO = 1.16    (FM)
        A = 0.52,  ASO = 0.52,     B = 0.40    (FM)

 MT=2 ELASTIC SCATTERING
```

OBTAINED BY SUBTRACTING THE SUM OF THE PARTIAL CROSS SECTIONS FROM THE TOTAL CROSS SECTION.

MT=4, 51-66, 91 INELASTIC SCATTERING

THE CROSS SECTIONS WERE TAKEN FROM JENDL FUSION FILE. THE LEVEL SCHEME WAS BASED ON REF./4/ CONTRIBUTIONS OF THE DIRECT PROCESS WERE CALCULATED FOR THE LEVELS MARKED WITH '*'.

NO.	ENERGY(MEV)	SPIN-PARITY	(DIRECT PROCESS)
G.S.	0.0	5/2 -	
1	0.1594	7/2 -	*
2	1.2521	9/2 -	*
3	1.254	1/2 -	
4	1.4442	11/2 -	*
5	1.5499	3/2 -	*
6	1.67	1/2 -	
7	1.7941	1/2 -	*
8	1.825	3/2 +	
9	2.163	3/2 -	*
10	2.1667	5/2 +	
11	2.2595	5/2 +	
12	2.2971	3/2 -	
13	2.344	5/2 +	
14	2.3649	1/2 +	
15	2.4062	5/2 -	
16	2.4163	1/2 -	

LEVELS ABOVE 2.416 MEV WERE ASSUMED TO BE OVERLAPPING.

MT=16, 22, 28, 103 (N,2N), (N,NA),(N,NP), (N,P)

ADOPTED FROM JENDL FUSION FILE. THEORETICAL CALCULATION WAS MADE WITH SINCROS-II. THE RESULTS WERE NORMALIZED TO

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      (N,2N)  0.200  B AT 14.9  MEV SYSTEMATICS BY KASUGAI/11/
(N,NP)+(N,D) 0.080  B AT 14.98 MEV MEASURED BY IKEDA ET AL./12/
      (N,P)   0.1215 B AT 14.91 MEV MEASURED BY IKEDA ET AL./12/
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MT=102 CAPTURE

CALCULATED WITH THE CASTHY CODE/10/ AND NORMALIZED TO 65.5 MB AT 30 KEV.

MT=107 (N,A)

CALCULATED WITH THE GNASH CODE/13/.

MT=251 MU-BAR

CALCULATED WITH OPTICAL MODEL.

MF=4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS

MT=2

CALCULATED WITH THE CASTHY CODE/10/.

MT=16,22,28,51-66, 91

TAKEN FROM JENDL FUSION FILE. THE DATA OF MT=16, 22, 28 AND 91 WERE TRANSFORMED INTO THE LAB SYSTEM.

MF=5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS

MT=16,22,28,51-66, 91

TAKEN FROM JENDL FUSION FILE. THE DATA OF MT=16, 22, 28 AND 91 WERE TRANSFORMED INTO THE LAB SYSTEM.

REFERENCES

1) CHIBA, S. ET AL.: JAERI-M 92-027, P.35 (1992).
2) YAMAMURO, N.: JAERI-M 90-006 (1990).
3) KUMABE, I. ET AL.: NUCL. SCI. ENG., 104, 280 (1990).
4) ENSDF: EVALUATED NUCLEAR STRUCTURE DATA FILE, BNL/NNDC.
5) MUGHABGHAB S.F. ET AL. : " NEUTRON CROSS SECTIONS ", VOL.1, PART A (1981).
6) PEREY, F.G.: PHYS. REV., 131, 745 (1963).
7) ARTHUR, E.D. AND YOUNG, P.G.: LA-8626-MS (1980).
8) LOHR, J.M. AND HAEBERLI W.: NUCL. PHYS., A232, 381 (1974).
9) BECCHETTI, F.D. JR. AND GREENLEES G.W.: "POLARIZATION PHENOMENA IN NUCL. REACTIONS," UNIV. WISCONSIN PRESS, P.682 (1971).
10) IGARASI S. AND FUKAHORI T.: JAERI 1321 (1991).
11) KASUGAI Y.: PRIVATE COMMUNICATION (1993).
12) IKEDA, Y. ET AL.: JAERI 1312 (1988).
13) YOUNG P.G. AND ARTHUR E.D. : LA-6947 (1977).

MAT number = 2231

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 22-TI- 48 KUR        EVAL-SEP88 K.KOBAYASHI(KUR),H.HASHIKURA(TOK)
                      DIST-SEP89 REV1-APR93
HISTORY
88-09  COMPILED BY T.ASAMI(NEDAC)
93-03  (4,91) CHANGED INTO LAB SYSTEM.
93-12 JENDL-3.2
       DATA WERE MAINLY ADOPTED FROM JENDL FUSION FILE.
      COMPILED BY T.NAKAGAWA

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      ALL CROSS SECTIONS EXCEPT (3,102) AND (3,107)
      ALL ANGULAR DISTRIBUTIONS EXCEPT FOR (4,2).
      ALL ENERGY DISTRIBUTIONS.
     ***********************************************************
     -------------------------------------------------------------
      JENDL FUSION FILE /1/  (AS OF DEC. 1993)
            EVALUATED BY K.KOSAKO (NEDAC) AND S. CHIBA (NDC/JAERI)
            COMPILED  BY K.KOSAKO.

      -  THE INELASTIC SCATTERING CROSS SECTIONS AND ANGULAR
         DISTRIBUTIONS OF INELASTICALLY SCATTERED NEUTRONS (EXCEPT
         CONTINUUM INELASTIC) WERE CALCULATED WITH CASTHY2Y AND
         DWUCKY IN SINCROS-II SYSTEM/2/ INCLUDING CONTRIBUTIONS
         FROM DIRECT REACTIONS.
      -  THE (N,2N), (N,NA), (N,NP) AND (N,P) REACTION CROSS
         SECTIONS (MT=16, 22, 28, 103) WERE CALCULATED BY EGNASH2
         IN THE SINCROS-II.
      -  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE REPLACED
         BY THOSE CALCULATED BY EGNASH2.  THE DDX'S OF THE
         CONTINUUM NEUTRONS WERE CALCULATED BY KUMABE'S SYSTEMA-
         TICS /3/ USING F15TOB /1/.  THE PRECOMPOUND/COMPOUND
         RATIO WAS CALCULATED BY THE SINCROS-II CODE SYSTEM.
      -  THE RESONANCE PARAMETERS, TOTAL, CAPTURE AND (N,A) CROSS
         SECTIONS AND ANG. DISTRIBUTIONS OF ELASTICALLY SCATTERED
         NEUTRONS WERE TAKEN FROM JENDL-3.1.
      -  OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED IN
         THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./2/.
         LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/4/.
     -------------------------------------------------------------


MF=1  GENERAL INFORMATION
 MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
 MT=151  RESOLVED RESONANCE PARAMETERS
   RESOLVED PARAMETERS FOR MLBW FORMULA WERE GIVEN IN THE ENERGY
   REGION FROM 1.0E-5 EV TO 100 KEV.  PARAMETERS WERE TAKEN FROM
   REF./5/, FOR POSITIVE RESONANCES.  PARAMETERS FOR NEGATIVE
   RESONANCE WERE OBTAINED SO THAT THE REPRODUCED CROSS SECTIONS
   FOR BOTH SCATTERING AND CAPTURE GAVE THE 2200 M/S VALUES OF
   4.61+-0.2 AND 7.84+-0.25 BARNS, RESPECTIVELY/5/.  THE SCATTER-
   ING RADIUS WAS ASSUMED TO BE 4.2 FERMI INSTEAD OF 3.9 FERMI IN
   REF./5/.  CALCULATED 2200 M/SEC CROSS SECTIONS AND RESONANCE
   INTEGRALS ARE AS FOLLOWS:

           2200 M/S CROSS SECTION(B)     RES. INTEGRAL(B)
    ELASTIC        4.61
    CAPTURE        7.84                        3.69
    TOTAL         12.45

MF=3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, NO BACKGROUND CROSS SECTION WAS GIVEN.

  FOR JENDL-3.2, ALL CROSS-SECTION DATA EXCEPT FOR THE TOTAL,
  CAPTURE AND (N,A) WERE ADOPTED FROM JENDL FUSION FILE.  THE
  CALCULATION WAS MADE WITH SINCROS-II SYSTEM/2/ BY ADOPTING
  WALTER-GUSS OMP MODIFIED BY YAMAMURO/2/ FOR NEUTRON, PEREY OMP
  /6/ FOR PROTON, LEMOS OMP MODIFIED BY ARTHUR AND YOUNG/7/ FOR
  ALPHA, LOHR-HAEBERLI OMP/8/ FOR DEUTERON, BECCHETTI-GREENLEES
  OMP/9/ FOR TRITON AND HE-3, AND STANDARD LEVEL DENSITY
  PARAMETERS OF SINCROS-II SYSTEM.

 MT=1 TOTAL
    OPTICAL AND STATISTICAL MODEL CALCULATION WAS MADE WITH
    CASTHY CODE/10/. THE OPTICAL POTENTIAL PARAMETERS USED ARE:
        V = 50.75 - 0.120*EN,    VSO = 4.72   (MEV)
       WS = 10.9 - 0.234*EN,      WV = 0.0    (MEV)
        R = 1.26,    RS = 1.02,   RSO = 1.16    (FM)
        A = 0.52,   ASO = 0.52,     B = 0.40    (FM)
    IN JENDL-3.1, THE TOTAL CROSS SECTION WAS NOT THE SAME AS THIS
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CALCULATION. FOR JENDL-3.2, IT WAS REPLACED WITH THE CASTHY
CALCULATION.

MT=2 ELASTIC SCATTERING
OBTAINED BY SUBTRACTING THE SUM OF THE PARTIAL CROSS SECTIONS
FROM THE TOTAL CROSS SECTION.

MT=4, 51-68, 91 INELASTIC SCATTERING
THE CROSS SECTIONS WERE TAKEN FROM JENDL FUSION FILE. THE
LEVEL SCHEME WAS BASED ON REF./4/ CONTRIBUTIONS OF THE DIRECT
PROCESS WERE CALCULATED FOR THE LEVELS MARKED WITH '*', USING
DEFORMATION PARAMETERS COMPILED BY RAMAN ET AL./11/ AND
SPEAR/12/.

NO.	ENERGY(MEV)	SPIN-PARITY	(DIRECT PROCESS)
G.S.	0.0	0+	
1	0.9835	2+	*
2	2.2956	4+	*
3	2.421	2+	*
4	2.9973	0+	*
5	3.224	3+	
6	3.2398	4+	*
7	3.3332	6+	
8	3.3588	3-	*
9	3.3709	2+	
10	3.5085	6+	
11	3.6168	2+	*
12	3.6336	2+	
13	3.6994	1+	
14	3.711	1+	
15	3.7386	1+	
16	3.7825	4-	
17	3.8028	1+	
18	3.8522	3-	*

LEVELS ABOVE 3.852 MEV WERE ASSUMED TO BE OVERLAPPING.

MT=16, 22, 28, 103 (N,2N), (N,NA),(N,NP), (N,P)
ADOPTED FROM JENDL FUSION FILE. THEORETICAL CALCULATION WAS
MADE WITH SINCROS-II. THE RESULTS WERE NORMALIZED TO

(N,NP)+(N,D) 0.0207 B AT 15.0 MEV MEASURED BY IKEDA ET AL./13/
(N,P) 0.0596 B AT 14.93 MEV MEASURED BY IKEDA ET AL./13/

MT=102   CAPTURE
CALCULATED WITH THE CASTHY CODE/10/ AND NORMALIZED TO 4.3 MB
AT 20 KEV.

MT=107   (N,A)
EVALUATED BASED ON THE EXPERIMENTAL DATA.

MT=251   MU-BAR
CALCULATED WITH OPTICAL MODEL.

MF=4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=2
CALCULATED WITH THE CASTHY CODE/10/
MT=16, 22, 28, 51-68, 91
TAKEN FROM JENDL FUSION FILE. THE DATA OF MT=16, 22, 28 AND
91 WERE TRANSFORMED INTO THE LAB SYSTEM.

MF=5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=16, 22, 28, 91
TAKEN FROM JENDL FUSION FILE. THE DATA OF MT=16, 22, 28 AND
91 WERE TRANSFORMED INTO THE LAB SYSTEM.

REFERENCES

1) CHIBA, S. ET AL.: JAERI-M 92-027, P.35 (1992).
2) YAMAMURO, N.: JAERI-M 90-006 (1990).
3) KUMABE, I. ET AL.: NUCL. SCI. ENG., 104, 280 (1990).
4) ENSDF: EVALUATED NUCLEAR STRUCTURE DATA FILE, BNL/NNDC.
5) MUGHABGHAB, S.F. ET AL.: " NEUTRON CROSS SECTIONS ", VOL.1, PART A (1981).
6) PEREY, F.G.: PHYS. REV., 131, 745 (1963).
7) ARTHUR, E.D. AND YOUNG, P.G.: LA-8626-MS (1980).
8) LOHR, J.M. AND HAEBERLI W.: NUCL. PHYS., A232, 381 (1974).
9) BECCHETTI, F.D. JR. AND GREENLEES G.W.: "POLARIZATION PHENOMENA IN NUCL. REACTIONS," UNIV. WISCONSIN PRESS, P.682 (1971).
10) IGARASI, S. AND FUKAHORI, T.: JAERI 1321 (1991).
11) RAMAN, S., ET AL.: ATOM. DATA AND NUCL. DATA TABLES 36, 1 (1987)
12) SPEAR, R.H.: ATOM. DATA AND NUCL. DATA TABLE, 42, 55 (1989).

13) IKEDA, Y. ET AL.: JAERI 1312 (1988).

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MAT number = 2234
 22-TI- 49 KUR        EVAL-SEP88 K.KOBAYASHI(KUR),H.HASHIKURA(TOK)
                      DIST-SEP89 REV2-NOV93
HISTORY
88-09 COMPILED BY T.ASAMI(NEDAC)
93-12 JENDL-3.2
       DATA WERE ADOPTED FROM JENDL FUSION FILE.
      COMPILED BY T.NAKAGAWA

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      ALL CROSS SECTIONS EXCEPT (3,1), (3,102) AND (3,107)
      (3,22) NEWLY ADDED.
      ALL ANGULAR DISTRIBUTIONS EXCEPT FOR (4,2).
      ALL ENERGY DISTRIBUTIONS.
     ***********************************************************
     -------------------------------------------------------------
      JENDL FUSION FILE /1/  (AS OF DEC. 1993)
            EVALUATED BY K.KOSAKO (NEDAC) AND S. CHIBA (NDC/JAERI)
            COMPILED  BY K.KOSAKO.

      -  THE INELASTIC SCATTERING CROSS SECTIONS AND ANGULAR
         DISTRIBUTIONS OF INELASTICALLY SCATTERED NEUTRONS (EXCEPT
         CONTINUUM INELASTIC) WERE CALCULATED WITH CASTHY2Y AND
         DWUCKY IN SINCROS-II SYSTEM/2/ INCLUDING CONTRIBUTIONS
         FROM DIRECT REACTIONS.
      -  THE (N,2N), (N,NA), (N,NP) AND (N,P) REACTION CROSS
         SECTIONS (MT=16, 22, 28, 103) WERE CALCULATED BY EGNASH2
         IN THE SINCROS-II.
      -  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE REPLACED
         BY THOSE CALCULATED BY EGNASH2.  THE DDX'S OF THE
         CONTINUUM NEUTRONS WERE CALCULATED BY KUMABE'S SYSTEMA-
         TICS /3/ USING F15TOB /1/.  THE PRECOMPOUND/COMPOUND
         RATIO WAS CALCULATED BY THE SINCROS- II CODE SYSTEM.
      -  THE RESONANCE PARAMETERS, TOTAL, CAPTURE AND (N,A) CROSS
         SECTIONS AND ANG. DISTRIBUTIONS OF ELASTICALLY SCATTERED
         NEUTRONS WERE TAKEN FROM JENDL-3.1.
      -  OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED IN
         THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./2/.
         LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/4/.
     -------------------------------------------------------------

MF=1  GENERAL INFORMATION
 MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
 MT=151  RESOLVED RESONANCE PARAMETERS
   RESOLVED PARAMETERS FOR MLBW FORMULA WERE GIVEN IN THE ENERGY
   REGION FROM 1.0E-5 EV TO 100 KEV.  PARAMETERS WERE TAKEN FROM
   REF./5/, FOR POSITIVE RESONANCES.  PARAMETERS FOR NEGATIVE
   RESONANCE WERE OBTAINED SO THAT THE REPRODUCED CROSS SECTIONS
   FOR BOTH SCATTERING AND CAPTURE GAVE THE 2200 M/S VALUES OF
   0.7+-0.3 AND 2.2+-0.3 BARNS, RESPECTIVELY/5/.  THE SCATTERING
   RADIUS WAS ASSUMED TO BE 4.5 FERMI INSTEAD OF 4.0 FERMI IN
   REF./5/.  CALCULATED 2200 M/SEC CROSS SECTIONS AND RESONANCE
   INTEGRALS ARE AS FOLLOWS:

            2200 M/S CROSS SECTION(B)     RES. INTEGRAL(B)
    ELASTIC        0.69
    CAPTURE        2.21                       1.06
    TOTAL          2.90

MF=3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, NO BACKGROUND CROSS SECTION WAS GIVEN.

  FOR JENDL-3.2, ALL CROSS-SECTION DATA EXCEPT FOR THE TOTAL,
  CAPTURE AND (N,A) WERE ADOPTED FROM JENDL FUSION FILE.  THE
  CALCULATION WAS MADE WITH SINCROS-II SYSTEM/2/ BY ADOPTING
  WALTER-GUSS OMP MODIFIED BY YAMAMURO/2/ FOR NEUTRON, PEREY OMP
  /6/ FOR PROTON, LEMOS OMP MODIFIED BY ARTHUR AND YOUNG/7/ FOR
  ALPHA, LOHR-HAEBERLI OMP/8/ FOR DEUTERON, BECCHETTI-GREENLEES
  OMP/9/ FOR TRITON AND HE-3, AND STANDARD LEVEL DENSITY
  PARAMETERS OF SINCROS-II SYSTEM.


 MT=1 TOTAL
   OPTICAL AND STATISTICAL MODEL CALCULATION WAS MADE WITH
   CASTHY CODE/2/. THE OPTICAL POTENTIAL PARAMETERS USED ARE:
        V = 50.75 - 0.120*EN,    VSO = 4.72   (MEV)
       WS = 10.9 - 0.234*EN,      WV = 0.0    (MEV)
        R = 1.26,   RS = 1.02,   RSO = 1.16    (FM)
        A = 0.52,  ASO = 0.52,     B = 0.40    (FM)
```

MT=2 ELASTIC SCATTERING
OBTAINED BY SUBTRACTING THE SUM OF THE PARTIAL CROSS SECTIONS FROM THE TOTAL CROSS SECTION.

MT=4, 51-65, 91 INELASTIC SCATTERING
THE CROSS SECTIONS WERE TAKEN FROM JENDL FUSION FILE. THE LEVEL SCHEME WAS BASED ON REF./4/ CONTRIBUTIONS OF THE DIRECT PROCESS WERE CALCULATED FOR THE LEVELS MARKED WITH '*'.

NO.	ENERGY(MEV)	SPIN-PARITY	(DIRECT PROCESS)
G.S.	0.0	7/2 -	
1	1.3818	3/2 -	*
2	1.5421	11/2 -	
3	1.586	3/2 -	*
4	1.6229	5/2 -	
5	1.7235	1/2 -	
6	1.762	5/2 -	*
7	2.2613	7/2 -	*
8	2.4714	7/2 -	
9	2.5044	1/2 +	*
10	2.5058	15/2 -	
11	2.5135	5/2 -	
12	2.5174	5/2 +	
13	2.6643	3/2 +	*
14	2.7201	11/2 -	
15	2.7213	3/2 -	

LEVELS ABOVE 2.721 MEV WERE ASSUMED TO BE OVERLAPPING.

MT=16, 22, 28, 103 (N,2N), (N,NA), (N,NP), (N,P)
ADOPTED FROM JENDL FUSION FILE. THEORETICAL CALCULATION WAS MADE WITH SINCROS-II. THE RESULTS WERE NORMALIZED TO

(N,NP)+(N,D) 0.00897B AT 14.98 MEV MEASURED BY IKEDA ET AL./10/
(N,P) 0.023 B AT 14.7 MEV MEASURED BY QAIM ET AL./11/

MT=102 CAPTURE
CALCULATED WITH THE CASTHY CODE/12/ AND NORMALIZED TO 22.5 MB AT 30 KEV.

MT=107 (N,A)
CALCULATED WITH THE GNASH CODE/13/.

MT=251 MU-BAR
CALCULATED WITH OPTICAL MODEL.

MF=4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=2
CALCULATED WITH THE CASTHY CODE/12/.
MT=16, 22, 28, 51-65, 91
TAKEN FROM JENDL FUSION FILE. THE DATA OF MT=16, 22, 28 AND 91 WERE TRANSFORMED INTO THE LAB SYSTEM.

MF=5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=16, 22, 28, 91
TAKEN FROM JENDL FUSION FILE. THE DATA OF MT=16, 22, 28 AND 91 WERE TRANSFORMED INTO THE LAB SYSTEM.

REFERENCES

1) CHIBA, S. ET AL.: JAERI-M 92-027, P.35 (1992).
2) YAMAMURO, N.: JAERI-M 90-006 (1990).
3) KUMABE, I. ET AL.: NUCL. SCI. ENG., 104, 280 (1990).
4) ENSDF: EVALUATED NUCLEAR STRUCTURE DATA FILE, BNL/NNDC.
5) MUGHABGHAB, S.F. ET AL.: " NEUTRON CROSS SECTIONS ", VOL.1, PART A (1981).
6) PEREY, F.G.: PHYS. REV., 131, 745 (1963).
7) ARTHUR, E.D. AND YOUNG, P.G.: LA-8626-MS (1980).
8) LOHR, J.M. AND HAEBERLI W.: NUCL. PHYS., A232, 381 (1974).
9) BECCHETTI, F.D. JR. AND GREENLEES G.W.: "POLARIZATION PHENOMENA IN NUCL. REACTIONS," UNIV. WISCONSIN PRESS, P.682 (1971).
10) IKEDA, Y. ET AL.: JAERI 1312 (1988).
11) QAIM, S.M. ET AL.: NUCL. PHYS., A283, 269 (1977).
12) IGARASI, S. AND FUKAHORI, T.: JAERI 1321 (1991).
13) YOUNG, P.G. AND ARTHUR, E.D.: LA-6947 (1977).

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MAT number = 2237
 22-TI- 50 KUR        EVAL-SEP88 K.KOBAYASHI(KUR),HASHIKURA(TOK)
                      DIST-SEP89 REV2-NOV93
HISTORY
88-09  COMPILED BY T.ASAMI(NEDAC)
93-11 JENDL-3.2
       DATA WERE MAINLY ADOPTED FROM JENDL FUSION FILE.
      COMPILED BY T.NAKAGAWA

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      ALL CROSS SECTIONS EXCEPT (3,1) AND (3,102)
      ALL ANGULAR DISTRIBUTIONS EXCEPT FOR (4,2).
      ALL ENERGY DISTRIBUTIONS.
     ***********************************************************
     -------------------------------------------------------------
      JENDL FUSION FILE /1/  (AS OF NOV. 1993)
            EVALUATED BY K.KOSAKO (NEDAC) AND S. CHIBA (NDC/JAERI)
            COMPILED  BY K.KOSAKO.

      -  THE INELASTIC SCATTERING CROSS SECTIONS AND ANGULAR
         DISTRIBUTIONS OF INELASTICALLY SCATTERED NEUTRONS (EXCEPT
         CONTINUUM INELASTIC) WERE CALCULATED WITH CASTHY2Y AND
         DWUCKY IN SINCROS-II SYSTEM/2/ INCLUDING CONTRIBUTIONS
         FROM DIRECT REACTIONS.
      -  THE (N,2N), (N,NA), (N,NP), (N,P) AND (N,A) REACTION
         CROSS SECTIONS (MT=16, 22, 28, 103, 107) WERE CALCULATED
         BY EGNASH2 IN THE SINCROS-II.
      -  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE REPLACED
         BY THOSE CALCULATED BY EGNASH2.  THE DDX'S OF THE
         CONTINUUM NEUTRONS WERE CALCULATED BY KUMABE'S SYSTEMA-
         TICS /3/ USING F15TOB /1/.  THE PRECOMPOUND/COMPOUND
         RATIO WAS CALCULATED BY THE SINCROS-II CODE SYSTEM.
      -  THE RESONANCE PARAMETERS, TOTAL AND CAPTURE CROSS
         SECTIONS AND ANG. DISTRIBUTIONS OF ELASTICALLY SCATTERED
         NEUTRONS WERE TAKEN FROM JENDL-3.1.
      -  OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED IN
         THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./2/.
         LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/4/.
     -------------------------------------------------------------


MF=1  GENERAL INFORMATION
 MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
 MT=151  RESOLVED RESONANCE PARAMETERS
   RESOLVED PARAMETERS FOR MLBW FORMULA WERE GIVEN IN THE ENERGY
   REGION FROM 1.0E-5 EV TO 200 KEV.  PARAMETERS WERE TAKEN FROM
   REF./5/, FOR POSITIVE RESONANCES.  PARAMETERS FOR NEGATIVE
   RESONANCE WERE OBTAINED SO THAT THE REPRODUCED CROSS SECTIONS
   FOR BOTH SCATTERING AND CAPTURE GAVE THE 2200 M/S VALUE OF
   3.7+-0.3 AND 0.179+-0.003 BARNS, RESPECTIVELY/5/.  THE
   SCATTERING RADIUS WAS ASSUMED TO BE 4.5 FERMI.  CALCULATED 2200
   M/SEC CROSS SECTIONS AND RESONANCE INTEGRALS ARE AS FOLLOWS:

            2200 M/S CROSS SECTION(B)     RES. INTEGRAL(B)
    ELASTIC        3.71
    CAPTURE        0.18                      0.086
    TOTAL          3.88

MF=3  NEUTRON CROSS SECTIONS
  BELOW 180 KEV, NO BACKGROUND CROSS SECTION WAS GIVEN.

  FOR JENDL-3.2, ALL CROSS-SECTION DATA EXCEPT FOR THE TOTAL AND
  CAPTURE WERE ADOPTED FROM JENDL FUSION FILE.  THE CALCULATION
  WAS MADE WITH SINCROS-II SYSTEM/2/ BY ADOPTING WALTER-GUSS OMP
  MODIFIED BY YAMAMURO/2/ FOR NEUTRON, PEREY OMP /6/ FOR PROTON,
  LEMOS OMP MODIFIED BY ARTHUR AND YOUNG/7/ FOR ALPHA, LOHR-
  HAEBERLI OMP/8/ FOR DEUTERON, BECCHETTII-GREENLEES OMP/9/ FOR
  TRITON AND HE-3, AND STANDARD LEVEL DENSITY PARAMETERS OF
  SINCROS-II SYSTEM.

 MT=1 TOTAL
   OPTICAL AND STATISTICAL MODEL CALCULATION WAS MADE WITH
   CASTHY CODE/10/. THE OPTICAL POTENTIAL PARAMETERS USED ARE:
         V = 50.75 - 0.120*EN,    VSO = 4.72   (MEV)
        WS = 10.9 - 0.234*EN,      WV = 0.0    (MEV)
         R = 1.26,   RS = 1.02,   RSO = 1.16    (FM)
         A = 0.52,  ASO = 0.52,     B = 0.40    (FM)

 MT=2 ELASTIC SCATTERING
   OBTAINED BY SUBTRACTING THE SUM OF THE PARTIAL CROSS SECTIONS
```

FROM THE TOTAL CROSS SECTION.

MT=4, 51-61, 91 INELASTIC SCATTERING
THE CROSS SECTIONS WERE TAKEN FROM JENDL FUSION FILE. THE LEVEL SCHEME WAS BASED ON REF./4/ CONTRIBUTIONS OF THE DIRECT PROCESS WERE CALCULATED FOR THE LEVELS MARKED WITH '*', USING DEFORMATION PARAMETERS COMPILED BY RAMAN ET AL./11/ AND SPEAR/12/.

NO.	ENERGY(MEV)	SPIN-PARITY	(DIRECT PROCESS)
G.S.	0.0	0 +	
1	1.5538	2 +	*
2	2.6749	4 +	*
3	3.1987	6 +	*
4	3.771	2 +	
5	3.8681	0 +	
6	3.9748	4 +	
7	4.1473	4 +	*
8	4.1718	3 +	
9	4.1723	2 +	*
10	4.311	2 +	*
11	4.4105	3 -	*

LEVELS ABOVE 4.411 MEV WERE ASSUMED TO BE OVERLAPPING.

MT=16, 22, 28, 103 (N,2N), (N,NA),(N,NP), (N,P)
ADOPTED FROM JENDL FUSION FILE. THEORETICAL CALCULATION WAS MADE WITH SINCROS-II. THE RESULTS WERE NORMALIZED TO

(N,2N) 1.0   B AT 14.9 MEV (SYSTEMATICS BY KASUGAI/13/),
(N,P) 0.0134 B AT 14.94 MEV MEASURED BY IKEDA ET AL./14/,
(N,A) 0.0104 B AT 14.95 MEV MEASURED BY IKEDA ET AL./14/.

MT=102   CAPTURE
CALCULATED WITH THE CASTHY CODE/10/ AND NORMALIZED TO 2.3 MB AT 25 KEV.

MT=251   MU-BAR
CALCULATED BASED ON OPTICAL MODEL

MF=4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=2
CALCULATED WITH THE CASTHY CODE/10/.
MT=16, 22, 28, 51-61, 91
TAKEN FROM JENDL FUSION FILE. THE DATA OF MT=16, 22, 28 AND 91 WERE TRANSFORMED INTO THE LAB SYSTEM.

MF=5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=16, 22, 28, 91
TAKEN FROM JENDL FUSION FILE. THE DATA OF MT=16, 22, 28 AND 91 WERE TRANSFORMED INTO THE LAB SYSTEM.

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12) SPEAR, R.H.: ATOM. DATA AND NUCL. DATA TABLE, 42, 55 (1989).
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MAT number = 2328
 23-V - 51 KHI          EVAL-AUG88 T.WATANABE
                        DIST-SEP89 REV2-MAR94
HISTORY
88-08 JENDL-2 MODIFIED BY T.WATANABE
                            (KAWASAKI HEAVY INDUSTRIES, LTD.)
94-03 MODIFICATION FOR JENDL FUSION FILE WAS MADE BY S.CHIBA
      GAMMA-RAY PRODUCTION DATA EVALUATED BY T.ASAMI(DATA ENG.)
      COMPILED BY S.CHIBA AND T.NAKAGAWA(NDC/JAERI)

****  MODIFIED PARTS FOR JENDL-3.2 ********************************
(3,2)                              TO KEEP THE TOTAL CROSS CROSS
                                   SECTION THE SAME AS JENDL-3.1.
(3,16)   BELOW 15 MEV                 TAKEN FROM JENDL FUSION FILE
(3,4),(3,22),(3,28),(3,51-65),(3,91) TAKEN FROM JENDL FUSION FILE
(4,16),(4,22),(4,28),(4,51-65),(4,91)TAKEN FROM JENDL FUSION FILE
(5,16),(5,22),(5,28),(5,91)           TAKEN FROM JENDL FUSION FILE
(12,51-64),(12,102),(12,103),(12,107)        NEW EVALUATION
(13,3)                                       NEW EVALUATION
(14,3),(14,51-64),(14,102),(14,103),(14,107) NEW EVALUATION
(15,3),(15,102),(15,103),(15,107)            NEW EVALUATION
******************************************************************
     -------------------------------------------------------------
      JENDL FUSION FILE /1/  (AS OF MAR. 1994)
            EVALUATED AND COMILED BY S. CHIBA (NDC/JAERI)

      DATA WERE TAKEN FROM JENDL-3.1 EXCEPT FOR THE FOLLOWING:
      -  THE DISCRETE AND CONTINUUM INELASTIC SCATTERING CROSS
         SECTIONS WERE CALCULATED WITH CASTHY2Y AND DWUCKY IN
         SINCROS-II SYSTEM/2/.
      -  ANGULAR DISTRIBUTIONS OF DISCRETE INELASTICS WERE ALSO
         CALCULATED WITH CASTHY2Y AND DWUCKY.
      -  THRESHOLD REACTION CROSS SECTIONS (MT=16, 22, 28) WERE
         REPLACED WITH THOSE CALCULATED BY EGNASH2 IN THE
         SINCROS-II. ABOVE 15 MEV, THE (N,2N) CROSS SECTION IS THE
         SAME AS JENDL-3.1.
      -  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE REPLACED
         BY THOSE CALCULATED BY EGNASH2.  THE DDX'S OF THE CONTI-
         NUUM NEUTRONS WERE CALCULATED BY KUMABE'S SYSTEMATICS
         /3/ USING F15TOB /1/.  THE PRECOMPOUND/COMPOUND RATIO
         WAS CALCULATED BY THE SINCROS- II CODE SYSTEM.
      -  OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED IN
         THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./2/.
         LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/4/.
     -------------------------------------------------------------


MF=1    GENERAL INFORMATION
  MT=451   DESCRIPTIVE DATA AND DICTIONARY

MF=2
  MT=151   RESONANCE PARAMETERS              : 1.0E-5 EV - 100 KEV
     RESOLVED RESONANCES FOR MLBW FORMULA:
        PARAMETERS WERE EVALUATED BASED ON EXPERIMENTAL DATA
        /5,6,7,8/ AND MODIFIED TO REPRODUCE EXPERIMENTAL TOTAL
        CROSS SECTIONS. NEGATIVE ENERGY LEVELS WERE ADDED TO
        REPRODUCE 2200 M/S TOTAL AND CAPTURE CROSS SECTIONS.

     CALCULATED 2200 M/S CROSS SECTIONS AND RESONANCE INTEGRALS
                     2200 M/SEC        RES. INTEG.
         ELASTIC       4.83 B              -
         CAPTURE       4.90 B             2.56 B
         TOTAL         9.73 B              -

MF=3    NEUTRON CROSS SECTIONS                      : ABOVE 100 KEV
     FOR JENDL-3.1, TOTAL, ELASTIC, INELASTIC AND CAPTURE CROSS
     SECTIONS WERE CALCULATED WITH OPTICAL AND STATISTICAL MODEL.
     DIRECT INELASTIC REACTION CROSS SECTIONS WERE EVALUATED WITH
     DWBA METHOD /9/ AND ADDED TO COMPOUND PROCESSES.

     THE SPHERICAL OPTICAL POTENTIAL PARAMETERS WERE EVALUATED
     TO REPRODUCE EXPERIMENTAL TOTAL CROSS SECTIONS /10,11,12/.
        V = 50.71-0.4793*EN MEV  R0= 1.227 FM  A0= 0.663 FM
        WS= 5.307-0.1911*EN MEV  RS= 1.370 FM  B = 0.394 FM
        VSO= 6.560 MEV           RSO=0.046 FM  ASO=0.535 FM

     OPTICAL AND STATISTICAL MODEL CALCULATION WAS PERFORMED
     WITH CASTHY CODE /13/.

     FOR JENDL-3.2, CROSS SECTIONS FOR (N,2N), (N,NP), (N,NA) AND
     INELASTIC SCATTERING WERE ADOPTED FROM JENDL FUSION FILE.
     THE CALCULATION WAS MADE WITH SINCROS-II CODE SYSTEM/2/ BY
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      ADOPTING WALTER-GUSS OMP MODIFIED BY YAMAMURO/2/ FOR
      NEUTRONS, LEMOS OMP MODIFIED BY ARTHUR AND YOUNG/14/ FOR
      ALPHA, LOHR-HAEBERLI/15/ FOR DEUTERON, BECHETTI-GREENLEES
      /16/ FOR TRITON AND HE-3.  LEVEL DENSITY PARAMETERS USED ARE:
           V-52          9.0      (1/MEV)
           V-51          8.6
           V-50          8.6
           TI-51         9.8
           TI-50         8.6
           SC-48         DEFAULT IN SINCROS-II
           SC-47         DEFAULT IN SINCROS-II

   MT=1   TOTAL
      100 KEV -2 MEV: BASED ON THE EXPERIMENTAL DATA /11,12/ FOR
                      NATURAL V.
      ABOVE    2 MEV: CALCULATED

   MT=2   ELASTIC SCATTERING
      OBTAINED BY SUBTRACTING THE SUM OF PARTIAL CROSS SECTIONS
      FROM THE TOTAL CROSS SECTION.

   MT=4,51-65,91 INELASTIC SCATTERING
      ADOPTED FROM JENDL FUSION FILE.

         THE LEVEL SCHEME TAKEN FROM REF./17/:
            NO.         ENERGY(MEV)   SPIN-PARITY     BETA
            G.S         0.0             7/2-
             1          0.3201          5/2-
             2          0.9270          3/2-          0.250
             3          1.6089         11/2-          0.250
             4          1.8131          9/2-          0.250
             5          2.4108          3/2-
             6          2.5474          1/2+
             7          2.6774          3/2+
             8          2.6996         15/2-
             9          2.79            9/2-
            10          3.0836          5/2-
            11          3.15            3/2-
            12          3.1951          3/2-
            13          3.2148          3/2-
            14          3.2640          5/2-
            15          3.2800          5/2-

         CONTINUUM LEVELS ASSUMED ABOVE 3.28 MEV

   MT=16  (N,2N)
      TAKEN FROM JENDL FUSION FILE.
         BELOW 15 MEV: SINCROS-II CALCULATION
         ABOVE 15 MEV: GUIDED BY EXPERIMENTAL DATA /18/.

   MT=22,28  (N,NA), (N,NP)
      DATA FOR JENDL FUSION FILE WERE ADOPTED, WHICH WERE
      CALCULATED WITH SINCROS-II.

   MT=102 CAPTURE
      STATISTICAL MODEL CALCULATION WITH CASTHY CODE /13/ WAS
      PERFORMED. THE CAPTURE CROSS SECTION WAS NORMALIZED TO THE
      EXPERIMENTAL DATA OF DUDEY+ /19/ AT 0.5 MEV 2.63 MB.

   MT=103 (N,P)
      GUIDED BY EXPERIMENTAL DATA /20,21/.

   MT=104,105  (N,D), (N,HE-3)
      JENDL-2 EVALUATED DATA /22/ WERE ADOPTED.

   MT=107 (N,ALPHA)
      GUIDED BY EXPERIMENTAL DATA /22,23,24,25/.

   MT=251 MU-BAR
      CALCULATED FROM THE DATA IN MF=4.

 MF=4    ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
   MT=2     CALCULATED WITH OPTICAL MODEL.
   MT=51-65
      TAKEN FROM JENDL FUSION FILE FOR WHICH THE CALCULATION WAS
      MADE WITH HAUSER-FESHBACH FORMULA (CASTHY) AND DWBA (DWUCK4).
   MT=16,22,28,91
      TAKEN FROM JENDL FUSION FILE.

 MF=5    ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
   MT=16,22,28,91
      TAKEN FROM JENDL FUSION FILE.
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MF=12  PHOTON PRODUCTION MULTIPLICITIES (UP TO 3.34494 MEV)
  MT=51-64
     MULTIPLICITIES WERE CALCULATED WITH EGNASH2/2/.
  MT=102
     FROM ENERGY BALANCE.
  MT=103, 107
     CALCULATED WITH THE EGNASH2 CODE/2/.

MF=13  PHOTON PRODUCTION CROSS SECTIONS (ABOVE 3.34494 MEV)
  MT=3
     CALCULATED WITH THE EGNASH2 CODE/2/.

MF=14  PHOTON ANGULAR DISTRIBUTIONS
  MT=3,51-64,102,103,107
     ASSUMED TO BE ISOTROPIC IN THE LABORATORY SYSTEM.

MF=15  CONTINUOUS PHOTON ENERGY SPECTRA
  MT=3, 102, 103, 107
     CALCULATED WITH THE EGNASH2 CODE/2/. CAPTURE GAMMA SPECTRUM
     AT THERMAL ENERGY WAS CALCULATED WITH CASTHY/6/.
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MAT number = 2400
 24-CR-  0 NEDAC       EVAL-MAR87 T.ASAMI(NEDAC)
                       DIST-SEP89 REV2-DEC93
HISTORY
87-03  NEW EVALUATION WAS MADE BY T.ASAMI.
88-12  MF/MT=3/107 MODIFIED.
89-08  MF/MT=15/102 MODIFIED.
93-12  JENDL-3.2.
        GAMMA-RAY PRODUCTION DATA REVISED BY T.ASAMI (DATA ENG.)
       COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (3,1), (3,2)          BETWEEN 300 KEV AND 4 MEV
      (4,16-28), (4,91)     TAKEN FROM JENDL FUSION FILE
      (5,16-91)             TAKEN FROM JENDL FUSION FILE
      (12,102)
      (13,3), (13,4)
      (15,102)
     ***********************************************************

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      JENDL FUSION FILE /1/  (AS IS AUG. 1993)
        EVALUATED B.YU (CIAE) AND S.CHIBA (NDC/JAERI)
        COMPILED BY B.YU.

          ALL OF CROSS SECTINOS WERE TAKEN FROM JENDL-3.  MF=6 OF
        MT=16, 22, 28 AND 91 WERE CREATED FROM SINCROS-II /2/ AND
        F15TOB/1/ PROGRAM.  MODIFIED-KUMABE'S SYSTEMATICS /1/ WAS
        USED.  THE PRECOMPOUND/COMPOUND RATIO WAS CALCULATED BY
        THE SINCROS-II CODE SYSTEM.
          OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED
        IN THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./2/.
        LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/3/.
     -------------------------------------------------------------


MF=1  GENERAL INFORMATION
 MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
 MT=151  RESOLVED RESONANCE PARAMETERS
   RESOLVED PARAMETERS FOR MLBW FORMULA WERE GIVEN IN THE ENERGY
   REGION FROM 1.0E-5 EV TO 300 KEV.  THE DATA WERE CONSTRUCTED
   FROM THE EVALUATED RESONANCE PARAMETERS FOR EACH CR ISOTOPE,
   CONSIDERING THEIR ABUNDANCES IN THE CR ELEMENT/4/.

            2200 M/S CROSS SECTION(B)     RES. INTEGRAL(B)
    ELASTIC       3.38
    CAPTURE       3.07                          1.53
    TOTAL         6.45

MF=3  NEUTRON CROSS SECTIONS
   BELOW 300 KEV, BACKGROUND CROSS SECTION WAS GIVEN.  AS THE
   EVALUATED DATA ON THE RESONANCE PARAMETERS OF CR-53 WERE GIVEN
   BELOW 120 KEV, THE CROSS SECTIONS OF CR-53 FOR TOTAL, ELASTIC
   SCATTERING AND CAPTURE IN THIS ENERGY RANGE, MULTIPLIED BY ITS
   ABUNDANCE, ARE PROVIDED AS THE BACKGROUND CROSS SECTIONS FOR
   MT=1, 2 AND 102.  ALL THE CROSS-SECTION DATA WERE DEDUCED FROM
   THE EVALUATED ONES FOR FOUR STABLE ISOTOPES OF CR CONSIDERING
   THEIR ABUNDANCES IN THE CR ELEMENT/4/, EXCEPT FOR THE TOTAL
   CROSS SECTIONS IN THE ENERGIES ABOVE 300 KEV.

 MT=1 TOTAL
   THE DATA IN THE ENERGY RANGE ABOVE 300 KEV WERE EVALUATED BASED
   ON THE EXPERIMENTAL DATA OF/5,6,7/. THE DATA IN REF./5/ WERE
   USED TO DETERMINE THE FINE STRUCTURE AND THOSE IN REFS.  /6/
   AND /7/ WERE USED FOR THE RE-NORMALIZATION OF THE ABOVE DATA
   AND FOR THE EVALUATION IN THE HIGH ENERGY REGION.  THUS
   OBTAINED CROSS SECTION WAS UNFOLDED BY CONSIDERING THE
   EXPERIMENTAL RESOLUTION OF 0.054 NSEC/M/5/ BELOW 4.4 MEV.

 MT=2 ELASTIC SCATTERING
   OBTAINED BY SUBTRACTING THE SUM OF THE PARTIAL CROSS SECTIONS
   FROM THE TOTAL CROSS SECTION.

 MT=4, 51-90, 91 INELASTIC SCATTERING
   THE DATA FOR EACH LEVEL WERE CONSTRUCTED FROM THE EVALUATIONS
   FOR EACH CR ISOTOPE AS FOLLOWS:

    MT   LEVEL ENERGY(MEV)   CR-50   CR-52  CR-53  CR-54
   G.S.       0.0
    51        0.5640                            51
```

52	0.7833	51			
53	0.8349				51
54	1.0063			52	
55	1.2895			53	
56	1.4341		51		
57	1.5366			54	
58	1.8237				52
59	1.8814	52			
60	1.9736			55	
61	2.1724			56	
62	2.2330			57	
63	2.3208			58	
64	2.3696		52		
65	2.4531			59	
66	2.6195				53
67	2.6470		53		
68	2.6570			60	
69	2.7677		54		
70	2.7720			61	
71	2.8266			62	
72	2.8294				54
73	2.9245	53			
74	2.9648		55		
75	2.9930			63	
76	3.0739				55
77	3.1138		56		
78	3.1600				56
79	3.1611	54			
80	3.1617		57		
81	3.3247	55			
82	3.4152		58		
83	3.4722		59		
84	3.6158		60		
85	3.7000		61		
86	3.7717		62		
87	3.9460		63		
88	4.0154		64		
89	4.5630		65		
90	4.6270		66		
91	3.0500	91	91	91	91

MT=16 (N,2N)
CONSTRUCTED FROM THE EVALUATED DATA FOR FOUR CR ISOTOPES
SO AS TO REPRODUCE THE EXPERIMENTAL DATA OF FREHAUT/8/.
MT=22 (N,NA)
CONSTRUCTED FROM THE EVALUATED DATA FOR FOUR CR ISOTOPES.
MT=28 (N,NP)
CONSTRUCTED FROM THE EVALUATED DATA FOR FOUR CR ISOTOPES.
MT=102 CAPTURE
CALCULATED WITH THE CASTHY CODE/9/ AND NORMALIZED TO 10 MB AT
50 KEV. Q-VALUE IS A WEIGHTED AVERAGE VALUE OF ISOTOPE Q
VALUES.
MT=103 (N,P)
CONSTRUCTED FROM THE EVALUATED DATA FOR FOUR CR ISOTOPES.
MT=107 (N,A)
CONSTRUCTED FROM THE EVALUATED DATA FOR FOUR CR ISOTOPES
SO AS TO REPRODUCE THE EXPERIMENTAL DATA OF PAULSEN/10/.
MT=251 MU-BAR
CALCULATED WITH OPTICAL MODEL.

MF=4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=2
CALCULATED WITH THE CASTHY CODE/9/.
MT=51-90
CALCULATED WITH THE CASTHY CODE.
MT=16, 22, 28, 91
TAKEN FROM JENDL FUSION FILE.

MF=5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=16, 22, 28, 91
TAKEN FROM JENDL FUSION FILE.

MF=12 PHOTON PRODUCTION MULTIPLICITIES
MT=102 (BELOW 2.5 MEV)
FROM ENERGY BALANCE.

MF=13 PHOTON PRODUCTION CROSS SECTIONS
MT=3 (ABOVE 2.5 MEV)
EVALUATED BASED ON THE EXPERIMENTAL DATA OF MORGAN/11/. BELOW
4.75 MEV, THE FINE STRUCTURES IN INELASTIC SCATTERING WERE
CONSIDERED.
MT=4 (BELOW 2.5 MEV)

```
    CALCULATED FROM INELASTIC SCATTERING CROSS SECTIONS AND
    GAMMA-RAY BRANCHING RATIOS OF ISOTOPES.

MF=14  PHOTON ANGULAR DISTRIBUTIONS
 MT=3, 4, 102
    ASSUMED TO BE ISOTROPIC.

MF=15  CONTINUOUS PHOTON ENERGY SPECTRA
 MT=3
    CALCULATED WITH THE GNASH CODE/12/.
 MT=102
    CALCULATED WITH THE CASTHY IN THE THERMAL ENERGY REGION
    AND WITH GNASH ABOVE 100 KEV.
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10) PAULSEN A. : NUCL. SCI. ENG. 78, 377 (1981).
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12) YOUNG P.G. AND ARTHUR E.D. : LA-6947 (1977).
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MAT number = 2425

```
 24-CR- 50 NEDAC        EVAL-MAR87 T.ASAMI(NEDAC)
                        DIST-SEP89 REV2-SEP93
HISTORY
87-03  NEW EVALUATION WAS MADE BY T.ASAMI.
88-12  MF/MT=3/107 MODIFIED.
93-09  JENDL-3.2.
       COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (4,16-28), (4,91)    TAKEN FROM JENDL FUSION FILE
      (5,16-91)            TAKEN FROM JENDL FUSION FILE
     ***********************************************************

     -------------------------------------------------------------
      JENDL FUSION FILE /1/  (AS OF SEP. 1993)
        EVALUATED B.YU (CIAE) AND S.CHIBA (NDC/JAERI)
        COMPILED BY B.YU.

          ALL OF CROSS SECTIONS WERE TAKEN FROM JENDL-3.  MF=6 OF
        MT=16, 22, 28 AND 91 WERE CREATED WITH SINCROS-II /2/ AND
        F15TOB/1/ PROGRAM.  MODIFIED-KUMABE'S SYSTEMATICS /1/ WAS
        USED.  THE PRECOMPOUND/COMPOUND RATIO WAS CALCULATED BY
        THE SINCROS-II CODE SYSTEM.
          OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED
        IN THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./2/.
        LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/3/.
     -------------------------------------------------------------


MF=1  GENERAL INFORMATION
 MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
 MT=151  RESOLVED RESONANCE PARAMETERS
   RESOLVED PARAMETERS FOR MLBW FORMULA WERE GIVEN IN THE ENERGY
   REGION FROM 1.0E-5 EV TO 300 KEV.  EVALUATION WAS BASED ON THE
   EXPERIMENTAL DATA OF STIEGLITZ+71/4/, BEER+74/5/, ALLEN+77/6/,
   KENNY+77/7/ AND BRUSEGAN+86/8/.  EFFECTIVE SCATTERING RADIUS =
   5.0 FM/9/.

    CALCULATED 2200 M/S CROSS SECTIONS AND RESONANCE INTEGRAL.
            2200 M/S CROSS SECTION(B)     RES. INTEGRAL(B)
    ELASTIC      2.31
    CAPTURE     15.9                           7.41
    TOTAL       18.2

MF=3  NEUTRON CROSS SECTIONS
    BELOW 300 KEV, ZERO BACKGROUND CROSS SECTION WAS GIVEN.

 MT=1 TOTAL
    OPTICAL AND STATISTICAL MODEL CALCULATION WAS MADE WITH THE
    CASTHY CODE/10/. THE OPTICAL POTENTIAL PARAMETERS USED ARE:
      V = 46.78 - 0.262*EN,    VSO = 7.0    (MEV)
     WS = 4.87 + 0.352*EN,      WV = 0      (MEV)
      R = 1.30,  RS = 1.40,  RSO = 1.30     (FM)
      A = 0.55,   B = 0.40,  ASO = 0.48     (FM)
       SURFACE IMAGINARY PART IS IN DERIVATIVE WOODS-SAXON FORM.

 MT=2 ELASTIC SCATTERING
    OBTAINED BY SUBTRACTING THE SUM OF THE PARTIAL CROSS SECTIONS
    FROM THE TOTAL CROSS SECTION.

 MT=4, 51-55, 91 INELASTIC SCATTERING
    CALCULATED WITH THE CASTHY CODE/10/, TAKING ACCOUNT OF THE
    CONTRIBUTION FROM THE COMPETING PROCESSES AND USING THE
    DISCRETE LEVEL DATA/11/ SHOWN BELOW.  THE CONTRIBUTIONS FROM
    THE DIRECT PROCESS FOR THE LEVEL MARKED WITH '*' WERE CALCULA-
    TED WITH THE DWUCK CODE/12/. THE DEFORMATION PARAMETERS USED
    IN THE CALCULATION WERE ASSUMED BASED ON PETERSON'S DATA/13/.

            LEVEL ENERGY(MEV)   SPIN-PARITY
       G.S.       0.0              0+
         1        0.7833           2+          *
         2        1.8814           4+          *
         3        2.9245           2+          *
         4        3.1611           2+          *
         5        3.1641           6+
         6        3.3247           4+
         7        3.5946           4+
         8        3.6101           4+
         9        3.6295           1+
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     10        3.6940              0+
     11        3.6978              2+
     12        3.7924              5+
     13        3.8261              6+
     14        3.8443              3+
     15        3.8500              0+
     16        3.8752              6+
     17        3.8953              2+
     18        3.8983              4+
     19        3.9377              3+
     20        4.0517              0+
   LEVELS ABOVE 4.066 MEV WERE ASSUMED TO BE OVERLAPPING.

THE CALCULATED DATA FOR THE INELASTIC SCATTERING WERE FINALLY
LUMPED FOR THE CONVENIENCE ON THE CONSTRUCTION OF THE ELEMENTA
DATA AS FOLLOWS:

   MT NO.    LEVEL ENERGY(MEV)  LUMPING OF LEVEL
     51         0.7833               1
     52         1.8814               2
     53         2.9245               3
     54         3.1611              4-5
     55         3.3247               6
     91         3.5946             OVER 7

FURTHERMORE, THE DATA OF MT=51 WERE MODIFIED BY CONSIDERING
EXPERIMENTAL DATA.  THE TOTAL INELASTIC SCATTERING CROSS SEC-
TION (MT=4) IS THE SUM OF MT'S FROM 51 TO 91.

MT=16       (N,2N)
   MAINLY BASED ON THE EXPERIMENTAL DATA OF BORMANN /14/.
MT=22       (N,NA)
   CALCULATED WITH THE GNASH CODE/15/.
MT=28       (N,NP)
   CALCULATED WITH THE GNASH CODE/15/.
MT=102      CAPTURE
   CALCULATED WITH THE CASTHY CODE/10/ AND NORMALIZED TO
   REPRODUCE THE ELEMENT DATA OF 10 MB AT 50 KEV.
MT=103      (N,P)
   CALCULATED WITH THE GNASH CODE/15/.
MT=107      (N,A)
   CALCULATED WITH THE GNASH CODE AND NORMALIZED AT 14.8 MEV IN
   REFERRING TO GRIMES'S DATA/16/. THE DATA NEAR THE THRESHOLD
   WERE MODIFIED IN REFERRING TO THE EXPERIMENTAL DATA FOR THE
   ELEMENT CR(N,ALPHA)/17/.
MT=251      MU-BAR
   CALCULATED WITH OPTICAL MODEL.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=2   ELASTIC SCATTERING
   CALCULATED WITH THE CASTHY CODE/10/.
 MT=16, 22, 28, 91   (N,2N), (N,NA), (N,NP), CONTINUUM INELASTIC
   APPROXIMATELY TRANSFORMED FROM THE MF=6 DATA (DDX) OF JENDL
   FUSION FILE.
 MT=51-55   INELASTIC SCATTERING
   CALCULATED WITH THE CASTHY CODE AND THE DWUCK CODE/12/.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=16, 22, 28, 91
   APPROXIMATELY TRANSFRMED FROM THE MF=6 DATA (DDX) OF JENDL
   FUSION FILE.
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REFERENCES


```
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 7) KENNY M.J. ET AL. : AAEC/E-400 (1977).
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MAT number = 2431

```
 24-CR- 52 NEDAC      EVAL-MAR87 T.ASAMI(NEDAC)
                      DIST-SEP89 REV2-SEP93
HISTORY
87-03  NEW EVALUATION WAS MADE BY T.ASAMI.
88-12  MF/MT=3/107 MODIFIED.
93-09  JENDL-3.2.
       COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (3,2)
      (3,4), (3,91)        TAKEN FROM JENDL FUSION FILE
      (3,66-67)            DELETED
      (4,16-28), (4,91)    TAKEN FROM JENDL FUSION FILE
      (5,16-91)            TAKEN FROM JENDL FUSION FILE
     ***********************************************************

     -------------------------------------------------------------
      JENDL FUSION FILE /1/  (AS OF SEP. 1993)
        EVALUATED B.YU (CIAE) AND S.CHIBA (NDC/JAERI)
        COMPILED BY B.YU.

            CROSS SECTIONS WERE MAINLY TAKEN FROM JENDL-3.  THE
        (N,N') CONTINUUM CROSS SECTION (MT=91) IN THE WHOLE ENERGY
        REGION AND ITS SPECTRA WERE TAKEN FROM THE SINCROS-II/2/
        CALCULATION.  SEVERAL DISCRETE LEVEL SCATTERING CROSS
        SECTIONS (MT=63, 64, 65, 66) AND THEIR ANGULAR DISTRIBU-
        TION WERE DELETED BECAUSE THEY WERE INCLUDED IN THE NEW
        CONTINUUM INELASTIC SCATTERING CROSS SECTION(MT=91) TAKEN
        FROM THE SINCROS-II CALCULATION.  THE THRESHOLD  OF MT=91
        WAS CHANGED FROM 4.65 MEV TO 3.8 MEV.  MF=6 OF MT=16, 22,
        28 AND 91 WERE CREATED BY F15TOB PROGRAM/1/.  MODIFIED-
        KUMABE'S SYSTEMATICS/1/ WAS USED.  THE PRECOMPOUND/COM-
        POUND RATIO WAS TAKEN FROM THE SINCROS-II CALCULATION.
          OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED
        IN THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./2/.
        LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/3/.
     -------------------------------------------------------------


MF=1  GENERAL INFORMATION
 MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
 MT=151  RESOLVED RESONANCE PARAMETERS
   RESOLVED PARAMETERS FOR MLBW FORMULA WERE GIVEN IN THE ENERGY
   REGION FROM 1.0E-5 EV TO 300 KEV.  EVALUATED MAINLY BASED ON
   THE EXPERIMENTAL DATA OF STIEGLITZ+ 71/4/, BEER+74/5/,
   ALLEN+77/6/, KENNY+77/7/, AGRAWAL+84/8/ AND BRUSEGAN+86/9/.
   EFFECTIVE SCATTERING RADIUS = 5.2 FM /10/

    CALCULATED 2200 M/S CROSS SECTIONS AND RESONANCE INTEGRAL
            2200 M/S CROSS SECTION(B)     RES. INTEGRAL(B)
    ELASTIC      2.96
    CAPTURE      0.76                          0.46
    TOTAL        3.72

MF=3  NEUTRON CROSS SECTIONS
    BELOW 300 KEV, ZERO BACKGROUND CROSS SECTION WAS GIVEN.
    ABOVE 300 KEV, THE TOTAL AND PARTIAL CROSS SECTIONS WERE GIVEN
    POINTWISE.

 MT=1 TOTAL
    OPTICAL AND STATISTICAL MODEL CALCULATION WAS MADE WITH
    THE CASTHY CODE/11/. THE OPTICAL POTENTIAL PARAMETERS USED ARE
      V = 46.78 - 0.262*EN,     VSO = 7.0     (MEV)
     WS = 4.87 + 0.352*EN,       WV = 0       (MEV)
      R = 1.30,  RS = 1.40,  RSO = 1.30       (FM)
      A = 0.55,   B = 0.40,  ASO = 0.48       (FM)
       SURFACE IMAGINARY PART IS IN DERIVATIVE WOODS-SAXON FORM.

 MT=2 ELASTIC SCATTERING
    OBTAINED BY SUBTRACTING THE SUM OF THE PARTIAL CROSS SECTIONS
    FROM THE TOTAL CROSS SECTION.

 MT=4, 51-62, 91 INELASTIC SCATTERING
    CALCULATED WITH THE CASTHY CODE/11/, TAKING ACCOUNT OF THE
    CONTRIBUTION FROM THE COMPETING PROCESSES AND USING THE
    DISCRETE LEVEL DATA/12/ SHOWN BELOW.  THE CONTRIBUTIONS FROM
    THE DIRECT PROCESS FOR THE LEVELS MARKED WITH '*' WERE
    CALCULATED WITH THE DWUCK CODE/13/. THE DEFORMATION PARAMETERS
    USED IN THE CALCULATION WERE ASSUMED BASED ON A WEAK COUPLING
```

MODEL.

	LEVEL ENERGY(MEV)	SPIN-PARITY	
G.S.	0.0	0+	
1	1.4341	2+	*
2	2.3696	4+	*
3	2.6470	0+	
4	2.7677	4+	
5	2.9648	2+	*
6	3.1138	6+	*
7	3.1617	2+	*
8	3.4152	4+	
9	3.4722	3+	
10	3.6158	5+	
11	3.7000	2+	
12	3.7717	2+	
13	3.9460	4+	
14	3.9512	1+	
15	4.0154	5+	
16	4.0380	4+	
17	4.5630	3-	*
18	4.6270	5+	
19	4.7060	2+	
20	4.7410	2+	
21	4.7507	8+	
22	4.7940	0+	
23	4.8045	6+	

LEVELS ABOVE 4.816 MEV WERE ASSUMED TO BE OVERLAPPING.

THE CALCULATED DATA FOR THE INELASTIC SCATTERING WERE FINALLY LUMPED FOR THE CONVENIENCE ON THE CONSTRUCTION OF THE ELEMENT DATA AS FOLLOWS:

MT NO.	LEVEL ENERGY(MEV)	LUMPING
51	1.4341	1
52	2.3696	2
53	2.6470	3
54	2.7677	4
55	2.9648	5
56	3.1138	6
57	3.1617	7
58	3.4152	8
59	3.4722	9
60	3.6158	10
61	3.7000	11
62	3.7717	12
63	3.9460	13-14
64	4.0154	15-16
65	4.5630	17
66	4.6270	18
91	4.7060	OVER 19

THE DATA OF MT=51 AND 52 WERE MODIFIED BY CONSIDERING EXPERIMENTAL DATA. THE TOTAL INELASTIC SCATTERING CROSS SECTION (MT=4) IS THE SUM OF MT'S FROM 51 TO 91. FOR JENDL-3.2, CROSS SECTIONS OF MT'S FROM 63 TO 66 WERE INCLUDED INTO MT=91. Q-VALUE OF MT=91 WAS CHANGED TO 3.8 MEV.

MT=16 (N,2N)
ADOPTED WERE THE EVALUATED DATA IN JENDL-2 WHICH HAVE BEEN EVALUATED BASED ON THE EXPERIMENTAL DATA OF WENUSCH+62/14/, BORMANN+68/15/, MASLOV+72/16/, QAIM72/17/, SAILER+77/18/ AND GHORAI+87/19/.

MT=22 (N,NA)
CALCULATED WITH THE GNASH CODE/20/ AND NORMALIZED.

MT=28 (N,NP)
CALCULATED WITH THE GNASH CODE/20/ AND NORMALIZED.

MT=102 CAPTURE
CALCULATED WITH THE CASTHY CODE/11/ AND NORMALIZED TO 28.5 MB AT 50 KEV SO AS TO REPRODUCE THE ELEMENT DATA OF 10 MB.

MT=103 (N,P)
CALCULATED WITH THE GNASH CODE/20/ AND NORMALIZED AT 14.8 MEV TO THE RECOMMENDED VALUE OF FORREST/21/.

MT=107 (N,A)
CALCULATED WITH THE GNASH CODE AND NORMALIZED AT 14.8 MEV TO THE AVERAGE VALUES OF THE EXPERIMENTAL DATA/22,23/. THE DATA WERE MODIFIED NEAR THE THRESHOLD IN REFERRING TO THE THE EXPERIMENTAL DATA OF PAULSEN /24/ FOR THE ELEMENT CR(N,A).

MT=251 MU-BAR
CALCULATED WITH OPTICAL MODEL.

MF=4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS

```
 MT=2    ELASTIC SCATTERING
    CALCULATED WITH THE CASTHY CODE/11/.
 MT=51-62    INELASTIC SCATTERING
    CALCULATED WITH THE CASTHY CODE/11/ AND THE DWUCK CODE/13/.
 MT=16, 22, 28, 91  (N,2N), (N,NA), (N,NP), CONTINUUM INELASTIC
    APPROXIMATELY TRANSFORMED FROM THE MF=6 DATA (DDX) OF JENDL
    FUSION FILE.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=16, 22, 28, 91
    APPROXIMATELY TRANSFORMED FROM THE MF=6 DATA (DDX) OF JENDL
    FUSION FILE.


REFERENCES
```

```
 1) CHIBA S. ET AL.: JAERI-M 92-027, P.35 (1992).
 2) YAMAMURO N.: JAERI-M 90-006 (1990).
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 6) ALLEN B.J. AND MUSGROVE A.R.DE L.: NEUTRON DATA OF STRUCTURAL
    MATERIALS FOR FBR, 1977 GEEL MEETING, P.447, PERGAMON PRESS
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12) DATA TAKEN FROM ENSDF(EVALUATED NUCLEAR STRUCTURE DATA FILE).
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24) PAULSEN A.: NUCL. SCI. ENG. 78, 377 (1981).
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MAT number = 2434

```
 24-CR- 53 NEDAC      EVAL-MAR87 T.ASAMI(NEDAC)
                      DIST-SEP89 REV2-SEP93
HISTORY
87-03  NEW EVALUATION WAS MADE FOR JENDL-3
88-12  MF/MT=3/107 MODIFIED.
93-09  JENDL-3.2.
       COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (4,16-28), (4,91)    TAKEN FROM JENDL FUSION FILE
      (5,16-91)            TAKEN FROM JENDL FUSION FILE
     ***********************************************************

     -------------------------------------------------------------
      JENDL FUSION FILE /1/  (AS OF SEP. 1993)
        EVALUATED B.YU (CIAE) AND S.CHIBA (NDC/JAERI)
        COMPILED BY B.YU.

          ALL OF CROSS SECTIONS WERE TAKEN FROM JENDL-3.  MF=6 OF
        MT=16, 22, 28 AND 91 WERE CREATED WITH SINCROS-II /2/ AND
        F15TOB/1/ PROGRAM.  MODIFIED-KUMABE'S SYSTEMATICS /1/ WAS
        USED.  THE PRECOMPOUND/COMPOUND RATIO WAS CALCULATED BY
        THE SINCROS-II CODE SYSTEM.
          OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED
        IN THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./2/.
        LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/3/.
     -------------------------------------------------------------


MF=1  GENERAL INFORMATION
 MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
 MT=151  RESOLVED RESONANCE PARAMETERS
   RESOLVED PARAMETERS FOR MLBW FORMULA WERE GIVEN IN THE ENERGY
   REGION FROM 1.0E-5 EV TO 120 KEV.  EVALUATED BASED ON THE
   EXPERIMENTAL DATA OF STIEGLITZ+71/4/, BEER+74/5/, ALLEN+77/6/,
   KENNY+77/7/, BRUSEGAN+86/8/ AND MUELLER+71/9/.  EFFECTIVE
   SCATTERING RADIUS = 5.4 FM/10/.

    CALCULATED 2200 M/S CROSS SECTIONS AND RESONANCE INTEGRAL.
            2200 M/S CROSS SECTION(B)     RES. INTEGRAL(B)
    ELASTIC      7.78
    CAPTURE     18.2                               8.61
    TOTAL       25.9

MF=3  NEUTRON CROSS SECTIONS
   BELOW 120 KEV, NO BACKGROUND CROSS SECTION WAS GIVEN.
   ABOVE 120 KEV, THE TOTAL AND PARTIAL CROSS SECTIONS WERE GIVEN
   POINTWISE.

 MT=1 TOTAL
    OPTICAL AND STATISTICAL MODEL CALCULATION WAS MADE WITH
    THE CASTHY CODE/11/. THE OPTICAL POTENTIAL PARAMETERS USED ARE
      V = 46.78 - 0.262*EN,    VSO = 7.0     (MEV)
     WS = 4.87 + 0.352*EN,      WV = 0       (MEV)
      R = 1.30,  RS = 1.40,  RSO = 1.30      (FM)
      A = 0.55,   B = 0.40,  ASO = 0.48      (FM)
       SURFACE IMAGINARY PART IS IN DERIVATIVE WOODS-SAXON FORM.

 MT=2 ELASTIC SCATTERING
    OBTAINED BY SUBTRACTING THE SUM OF THE PARTIAL CROSS SECTIONS
    FROM THE TOTAL CROSS SECTION.

 MT=4, 51-63, 91 INELASTIC SCATTERING
    CALCULATED WITH THE CASTHY CODE/11/, TAKING ACCOUNT OF THE
    CONTRIBUTION FROM THE COMPETING PROCESSES AND USING THE
    DISCRETE LEVEL DATA/3/ SHOWN BELOW.  THE CONTRIBUTIONS FROM
    THE DIRECT PROCESS FOR THE LEVELS MARKED WITH '*' WERE
    CALCULATED WITH THE DWUCK CODE/12/. THE DEFORMATION PARAME-
    TERS USED IN THE CALCULATION WERE ASSUMED BASED ON A WEAK
    COUPLING MODEL.

              LEVEL ENERGY(MEV)   SPIN-PARITY
        G.S.      0.0               3/2-
          1       0.5640            1/2-        *
          2       1.0063            5/2-        *
          3       1.2895            7/2-        *
          4       1.5366            7/2-        *
          5       1.9736            5/2-        *
          6       2.1724           11/2-
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           7        2.2330             9/2-
           8        2.3208             3/2-
           9        2.4531             3/2-
          10        2.6570             5/2-
          11        2.6695             1/2-
          12        2.7065            13/2-
          13        2.7080             3/2-
          14        2.7720             5/2-
          15        2.8266            11/2-
          16        2.9930             7/2-
          17        3.0841            15/2-
          18        3.0930             5/2-
          19        3.1380             5/2-
          20        3.1793             3/2-
          21        3.2439            11/2-
          22        3.2610             5/2-
        LEVELS ABOVE 3.435 MEV WERE ASSUMED TO BE OVERLAPPING.

   THE CALCULATED DATA FOR THE INELASTIC SCATTERING WERE FINALLY
   LUMPED FOR THE CONVENIEINCE ON THE CONSTRUCTION OF THE ELEMENT
   DATA AS FOLLOWS:

        MT NO.    LEVEL ENERGY(MEV)  LUMPING
          51          0.5640           1
          52          1.0063           2
          53          1.2895           3
          54          1.5366           4
          55          1.9736           5
          56          2.1724           6
          57          2.2330           7
          58          2.3208           8
          59          2.4531           9
          60          2.6570         10-13
          61          2.7720          14
          62          2.8266          15
          63          2.9930          16
          91          2.9930         OVER 17

  MT=16        (N,2N)
     CALCULATED WITH THE GNASH CODE/13/.
  MT=22        (N,NA)
     CALCULATED WITH THE GNASH CODE AND NORMALIZED.
  MT=28        (N,NP)
     CALCULATED WITH THE GNASH CODE AND NORMALIZED.
  MT=102       CAPTURE
     CALCULATED WITH THE CASTHY CODE/11/ AND NORMALIZED AT 50 KEV
     TO REPRODUCE THE ELEMENT DATA OF 10 MB.
  MT=103       (N,P)
     BELOW 9 MEV, EVALUATED BASED ON THE EXPERIMENTAL DATA OF
     SMITH/14/.  ABOVE 9 MEV, CALCULATED WITH THE GNASH CODE/13/
     AND NORMALIZED SO AS TO BE CONNECTED WITH SMITH'S EXPERIMENTAL
     DATA/14/.
  MT=107       (N,A)
     CALCULATED WITH THE GNASH CODE/13/ AND NORMALIZED AT 14.7 MEV
     TO DOLJA'S EXPERIMENTAL DATA/15/. THE DATA NEAR THRESHOLD
     WERE MODIFIED IN REFERRING TO THE EXPERIMENTAL DATA FOR THE
     ELEMENT CR(N,ALPHA)/16/.
  MT=251       MU-BAR
     CALCULATED WITH OPTICAL MODEL.

 MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2    ELASTIC SCATTERING
     CALCULATED WITH THE CASTHY CODE/11/.
  MT=51-63    INELASTIC SCATTERING
     CALCULATED WITH THE CASTHY CODE AND THE DWUCK CODE/12/.
  MT=16, 22, 28, 91  (N,2N), (N,NA), (N,NP), CONTINUUM INELASTIC
     APPROXIMATELY TRANSFORMED FROM THE MF=6 DATA (DDX) OF JENDL
     FUSION FILE.

 MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16, 22, 28, 91
     APPROXIMATELY TRANSFORMED FROM THE MF=6 DATA (DDX) OF JENDL
     FUSION FILE.
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MAT number = 2437

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 24-CR- 54 NEDAC      EVAL-MAR87 T.ASAMI(NEDAC)
                      DIST-SEP89 REV2-SEP93
HISTORY
87-03  NEW EVALUATION WAS MADE FOR JENDL-3.
93-09  JENDL-3.2.
       COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (4,16-28), (4,91)    TAKEN FROM JENDL FUSION FILE
      (5,16-91)            TAKEN FROM JENDL FUSION FILE
     ***********************************************************

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      JENDL FUSION FILE /1/  (AS OF SEP. 1993)
        EVALUATED B.YU (CIAE) AND S.CHIBA (NDC/JAERI)
        COMPILED BY B.YU.

          ALL OF CROSS SECTIONS WERE TAKEN FROM JENDL-3.  MF=6 OF
        MT=16, 22, 28 AND 91 WERE CREATED WITH SINCROS-II /2/ AND
        F15TOB/1/ PROGRAM.  MODIFIED-KUMABE'S SYSTEMATICS /1/ WAS
        USED.  THE PRECOMPOUND/COMPOUND RATIO WAS CALCULATED BY
        THE SINCROS-II CODE SYSTEM.
          OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED
        IN THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./2/.
        LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/3/.
     -------------------------------------------------------------


MF=1  GENERAL INFORMATION
 MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
 MT=151  RESOLVED RESONANCE PARAMETERS
   RESOLVED PARAMETERS FOR MLBW FORMULA WERE GIVEN IN THE ENERGY
   REGION FROM 1.0E-5 EV TO 300 KEV.  EVALUATED BASED ON THE
   EXPERIMENTAL DATA OF STIEGLITZ+71/4/, BEER+74/5/, ALLEN+77/6/,
   KENNY+77/7/ AND BRUSEGAN+86/8/.  EFFECTIVE SCATTERING RADIUS =
   5.3 FM/9/.

    CALCULATED 2200 M/S CROSS SECTIONS AND RESONANCE INTEGRAL.
            2200 M/S CROSS SECTION(B)     RES. INTEGRAL(B)
    ELASTIC       2.54
    CAPTURE       0.36                          0.18
    TOTAL         2.90

MF=3  NEUTRON CROSS SECTIONS
    BELOW 300 KEV, NO BACKGROUND CROSS SECTION WAS GIVEN.
    ABOVE 300 KEV, THE TOTAL AND PARTIAL CROSS SECTIONS WERE GIVEN
    POINTWISE.

 MT=1 TOTAL
    OPTICAL AND STATISTICAL MODEL CALCULATION WAS MADE WITH THE
    CASTHY CODE/10/. THE OPTICAL POTENTIAL PARAMETERS USED ARE:
      V = 46.78 - 0.262*EN,    VSO = 7.0     (MEV)
     WS = 4.87 + 0.352*EN,      WV = 0       (MEV)
      R = 1.30,  RS = 1.40,  RSO = 1.30     (FM)
      A = 0.55,   B = 0.40,  ASO = 0.48     (FM)
       SURFACE IMAGINARY PART IS IN DERIVATIVE WOODS-SAXON FORM.

 MT=2 ELASTIC SCATTERING
    OBTAINED BY SUBTRACTING THE SUM OF THE PARTIAL CROSS SECTIONS
    FROM THE TOTAL CROSS SECTION.

 MT=4, 51-60, 91 INELASTIC SCATTERING
    CALCULATED WITH THE CASTHY CODE/10/, TAKING ACCOUNT OF THE
    CON- TRIBUTION FROM THE COMPETING PROCESSES AND USING THE
    DISCRETE LEVEL DATA/3/ SHOWN BELOW.  THE CONTRIBUTIONS FROM
    THE DIRECT PROCESS FOR THE LEVELS MARKED WITH '*' WERE CALCU-
    LATED WITH THE DWUCK CODE/11/. THE DEFORMATION PARAMETERS USED
    IN THE CALCULATION WERE ASSUMED BASED ON A WEAK COUPLING
    MODEL.
              LEVEL ENERGY(MEV)   SPIN-PARITY
        G.S.       0.0                0+
          1        0.8349             2+           *
          2        1.8237             4+           *
          3        2.6195             2+           *
          4        2.8294             0+           *
          5        3.0739             2+           *
          6        3.1600             2+           *
          7        3.2225             6+
          8        3.3920             1+
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9	3.4366	2+
10	3.4680	1+
11	3.5140	2+
12	3.6552	4+
13	3.7198	2+
14	3.7858	4+
15	3.7989	4+
16	3.8640	2+
17	3.9340	1+
18	3.9900	3+
19	4.0160	0+
20	4.0450	6+
21	4.0832	4+

LEVELS ABOVE 4.088 MEV WERE ASSUMED TO BE OVERLAPPING.

THE CALCULATED DATA FOR THE INELASTIC SCATTERING WERE FINALLY LUMPED FOR THE CONVENIENCE ON THE CONSTRUCTION OF THE ELEMENT DATA AS FOLLOWS:

MT NO.	LEVEL ENERGY(MEV)	LUMPING
51	0.8349	1
52	1.8237	2
53	2.6195	3
54	2.8294	4
55	3.0739	5
56	3.1600	6
57	3.2225	7
58	3.3920	8
59	3.4366	9
60	3.4680	10
91	3.5140	OVER 11

MT=16 (N,2N)
CALCULATED WITH THE GNASH CODE/12/.
MT=22 (N,NA)
CALCULATED WITH THE GNASH CODE AND NORMALIZED.
MT=28 (N,NP)
CALCULATED WITH THE GNASH CODE AND NORMALIZED.
MT=102 CAPTURE
CALCULATED WITH THE CASTHY CODE/10/ AND NORMALIZED AT 50 KEV SO AS TO REPRODUCE THE ELEMENT DATA OF 10 MB.
MT=103 (N,P)
CALCULATED WITH THE GNASH CODE/12/ AND NORMALIZED AT 14.7 MEV TO AN AVERAGE VALUE OF THE EXPERIMENTAL DATA/13,14,15/.
MT=107 (N,A)
CALCULATED WITH THE GNASH CODE AND NORMALIZED AT 14.8 MEV TO AN AVERAGE VALUE OF THE EXPERIMENTAL DATA/14,15,16/.
MT=251 MU-BAR
CALCULATED WITH OPTICAL MODEL.

MF=4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=2 ELASTIC SCATTERING
CALCULATED WITH THE CASTHY CODE/10/.
MT=51-60 INELASTIC SCATTERING
CALCULATED WITH THE CASTHY CODE AND THE DWUCK CODE/11/.
MT=16, 22, 28, 91 (N,2N), (N,NA), (N,NP), CONTINUUM INELASTIC
APPROXIMATELY TRANSFORMED FROM THE MF=6 DATA (DDX) OF JENDL FUSION FILE.

MF=5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=16, 22, 28, 91
APPROXIMATELY TRANSFORMED FROM THE MF=6 DATA (DDX) OF JENDL FUSION FILE.

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MAT number = 2525

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 25-MN- 55 JAERI,MAPI EVAL-MAR87 K.SHIBATA,T.HOJUYAMA
 NST 26, 955 (1989)   DIST-SEP89 REV2-AUG93
HISTORY
87-03  RESONANCE PARAMETERS WERE EVALUATED BY T.HOJUYAMA (MAPI).
       MULTISTEP HAUSER-FESHBACH CALCULATIONS WERE PERFORMED
       BY K.SHIBATA (JAERI).
88-01  COMPILED BY K.SHIBATA (JAERI).
88-03  COVARIANCE DATA ADDED
91-08  MODIFED  BY B.YU (CIAE) AND S.CHIBA (NDC/JAERI) AS FOLLOWS
       FOR JENDL FUSION FILE/20/.
       COMPILED BY B.YU.
     CROSS SECTIONS WERE MAINLY TAKEN FROM JENDL-3.1.  THE (N,N')
 CONTINUMM CROSS SECTION (MT=91) IN THE WHOLE ENERGY REGION AND
 ITS SPECTRA WERE TAKEN FROM THE SINCROS-II /21/ CALCULATION.
 SEVERAL DISCRETE LEVEL SCATTERING CROSS SECTIONS (MT=67, 68, 69,
 70, 71, 72, 73, 74, 75, 76, 77, 78, 79) AND THEIR ANGULAR DISTRI-
 BUTIONS WERE DELETED AS WELL AS THEIR COVARIANCE MATRICES
 BECAUSE THEY ARE INCLUDED IN THE NEW CONTINUUM INELASTIC
 SCATTERING CROSS SECTION TAKEN FROM THE SINCROS-II CALCULATION.
93-08  JENDL-3.2
       FILE-6 OF THE JENDL FUSION FILE WAS CONVERTED TO FILES 4
       AND 5.
       DATA WERE COMPILED BY K. SHIBATA (JAERI).


MF=1          GENERAL INFORMATION
  MT=451    DESCRIPTIVE DATA AND DICTIONARY

MF=2          RESONANCE PARAMETERS
  MT=151    RESOLVED RESONANCE PARAMETERS FOR MLBW FORMULA
     THE PARAMETERS OF THE LOWEST FOUR RESONANCES WERE TAKEN
     FROM THE WORK OF MACKLIN /1/.  OTHERS WERE TAKEN FROM THE
     COMPILATION OF MUGHABGHAB ET AL./2/ EXCEPT THAT THE
     PARAMETERS OF TWO NEGATIVE RESONANCES WERE ADJUSTED SO AS
     TO FIT TO EXPERIMENTAL THERMAL CROSS SECTIONS.
     RESONANCE REGION : 1.0E-5 EV TO 100 KEV.
     SCATTERING RADIUS: 5.15 FM
     CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS
                  2200-M/S          RES. INTEG.
      ELASTIC      2.167 B             -
      CAPTURE     13.413 B           11.77  B
      TOTAL       15.579 B             -

MF=3          NEUTRON CROSS SECTIONS
  MT=1      TOTAL
      BELOW 100 KEV   : NO BACKGROUND
      ABOVE 100 KEV   : BASED ON THE EXPERIMENTAL DATA /3,4,5/.
  MT=2      ELASTIC SCATTERING
      (TOTAL) - (NONELASTIC CROSS SECTION)
  MT=3      NON ELASTIC
      SUM OF MT=4, 16, 22, 28, 102, 103, 104, 105, 106 AND 107
  MT=4,51-66,91 INELASTIC SCATTERING
      STATISTICAL-MODEL CALCULATIONS WERE PERFORMED USING THE
      TNG CODE /6/.  THE PRECOMPOUND PROCESS WAS CONSIDERED
      ABOVE 5 MEV.  THE CALCULATED CROSS SECTION OF MT=51
      WAS MULTIPLIED BY A FACTOR OF 1.2.
      FOR THE LEVELS OF MT=51,52,57,61,64,65,67,70,
      THE DIRECT PROCESS COMPONENTS WERE TAKEN INTO ACCOUNT
      BY THE DWBA CALCULATIONS.
      THE OPTICAL POTENTIAL PARAMETERS USED ARE AS FOLLOWS/7/
      (IN THE UNITS OF MEV AND FM):
   V  = 49.747 - 0.4295*E - 0.0003*E**2  R0 = 1.287  A0  = 0.56
   WS = 11.2 - 0.09*E                    RS = 1.345  AS  = 0.47
   VSO= 6.2                              RSO= 1.120  ASO = 0.47
      THE LEVEL SCHEME WAS TAKEN FROM REF./8/.
        NO.    ENERGY(MEV) SPIN-PARITY
        G.S.      0.0         5/2 -
         1.       0.126       7/2 -
         2.       0.984       9/2 -
         3.       1.290       1/2 -
         4.       1.292      11/2 -
         5.       1.293       1/2 -
         6.       1.528       3/2 -
         7.       1.884       7/2 -
         8.       2.015       7/2 -
         9.       2.198       7/2 -
        10.       2.215       5/2 -
        11.       2.252       3/2 -
        12.       2.267       5/2 -
        13.       2.312      13/2 -
        14.       2.366       5/2 -
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     15.        2.398       9/2 +
     16.        2.427       1/2 +
     17.        2.563       3/2 -
     18.        2.727       7/2 -
     19.        2.753       5/2 -
     20.        2.822       9/2 -
     21.        2.824       5/2 -
     22.        2.873       1/2 -
     23.        2.954       3/2 -
     24.        2.976       3/2 -
     25.        2.992       7/2 -
     26.        3.006       3/2 -
     27.        3.036      11/2 -
     28.        3.038       1/2 -
     29.        3.040       3/2 +

   LEVELS ABOVE 3.046 MEV WERE ASSUMED TO BE OVERLAPPING.
   *****  JENDL-3.2 ***************************************
   THE CROSS SECTIONS FOR MT=67-79 WERE DELETED AND THAT FOR
   MT=91 WAS MODIFIED SO THAT THE CALCULATED SPECTRA COULD
   GIVE A BETTER FIT TO THE MEASURED DDX DATA.
   ********************************************************

MT=16,22,28,103,107 (N,2N),(N,N'A),(N,N'P),(N,P) AND (N,A)
  CROSS SECTIONS
   CALCULATED WITH TNG.
   GLOBAL OPTICAL-POTENTIAL PARAMETERS WERE EMPLOYED
   FOR PROTONS AND ALPHA-PARTICLES /9,10/.

MT=102    RADIATIVE CAPTURE CROSS SECTION
   BELOW 100 KEV : RESONANCE PARAMETERS GIVEN (NO BACKGROUND)
   ABOVE 100 KEV : BASED ON THE EXPERIMENTAL DATA /11/-/15/.

MT=104    (N,D) CROSS SECTION
   THE EXCITATION FUNCTION OF THE (N,P) CROSS SECTION
   CALCULATED WITH TNG WAS USED FOR THE (N,D) REACTION BY
   SHIFTING THE THRESHOLD ENERGY.  THE CROSS SECTIONS WERE
   NORMALIZED TO THE EXPERIMENTAL DATUM AT 14.1 MEV /16/.

MT=105    (N,T) CROSS SECTION
   THE EXCITATION FUNCTION OF THE (N,P) CROSS SECTION
   CALCULATED WITH TNG WAS USED FOR THE (N,T) REACTION BY
   SHIFTING THE THRESHOLD ENERGY.  THE CROSS SECTIONS WERE
   NORMALIZED TO THE EXPERIMENTAL DATUM AT 14.7 MEV /17/.

MT=106    (N,HE-3) CROSS SECTION
   BASED ON THE EXPERIMENTAL DATA /18,19/.

MT=251    MU-BAR
   CALCULATED FROM FILE-4.

MF=4        ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=2,51-66
   OPTICAL AND STATISTICAL-MODEL CALCULATIONS
   THE COMPONENTS OF THE DIRECT PROCESS WERE ADDED TO
   THE LEVELS OF MT=51,52,57,61,64,65 BY THE DWBA
   CALCULATIONS.
 MT=16, 22, 28, 91
   CONVERTED FROM THE FILE-6 OF THE JENDL FUSION FILE.

MF=5        ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=16, 22, 28, 91
   CONVERTED FROM THE FILE-6 OF THE JENDL FUSION FILE.

MF=12       PHOTON PRODUCTION MULTIPLICITIES
 MT=4,16,22,28,102,103,107
   CALCULATED WITH TNG.
   FOR MT=102, MODIFIED BY USING GAMMA-RAY INTENSITY DATA
   IN ENSDF BELOW THERMAL ENERGY.

MF=14       PHOTON ANGULAR DISTRIBUTIONS
 MT=4,16,22,28,102,103,107
   ASSUMED TO BE ISOTROPIC.

MF=15       PHOTON ENERGY DISTRIBUTIONS
 MT=4,16,22,28,102,103,107
   CALCULATED WITH TNG.
   FOR MT=102, MODIFIED BY USING GAMMA-RAY INTENSITY DATA
   IN ENSDF BELOW THERMAL ENERGY.

MF=33       COVARIANCE DATA
 MT=1,2,3,4,16,22,28,51-66,91,102,103,104,105,106,107
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ESTIMATED FROM EXPERIMENTAL DATA.

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MAT number = 2600

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 26-FE-  0 JNDC       EVAL-MAR87 S.IIJIMA,H.YAMAKOSHI
                      DIST-SEP89 REV2-MAR94
HISTORY
87-03  EVALUATION WAS PERFORMED FOR JENDL-3.
87-05  COMPILED BY K.SHIBATA (JAERI).
*****  JENDL-3.2  *********************************************
92-09  MODIFICATION WAS MADE FOR TOTAL AND ELASTIC SCATTERING
       CROSS SECTIONS.
93-11  THE RESONACE PARAMETERS OF FE-58 WERE MODIFIED.
       INEALSTIC SCATTERING CROSS SECTIONS WERE REEVALUATED BY
       K. SHIBATA (JAERI).  DISCRETE LEVELS WERE LUMPED SO THAT
       REACTION KINEMATICS COULD BE PROPERLY TAKEN INTO ACCOUNT.
       FILES 4 AND 5 FOR MT=16,22,28,91 WERE OBTAINED FROM THE
       FILE-6 OF THE JENDL FUSION FILE /16/.
       GAMMA PRODUCTION DATA WERE REVALUATED BY S.IGARASI (NEDAC).
94-03  FOR (3,3),(3,107),(13,107), SMALL CROSS-SECTION VALUES
       WERE REPLACED WITH 0.0.
****************************************************************

NATURAL IRON DATA CONSTRUCTED FROM FE-ISOTOPES.

MF=1  GENERAL INFORMATION
  MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
  MT=151 RESOLVED RESONANCES
      RESONANCE REGION = 1.0E-5 EV TO 250.0 KEV
      THE MULTILEVEL BREIT-WIGNER FORMULA WAS USED.  PARAMETERS
      WERE ADOPTED FROM THE FOLLOWING SOURCES.
         FE-54 : PANDEY+/1/ FOR 0 - 680 KEV. R=5.6 FM
         FE-56 : PEREY+/2/ FOR -2.0 - 400 KEV. R=5.4 FM FROM FIT-
                 TING TO TOTAL CROSS SECTION BELOW 60 KEV.
                 PARAMETERS OF THE 1.15 KEV RESONANCE WERE
                 TAKEN FROM THE RESULT OF THE NEANDC TASK
                 FORCE /3/.
         FE-57 : ALLEN+/4/ FOR S-WAVE RESONANCES, AND BEER+/5/
                 FOR P-WAVE RESONANCES IN 0 - 185 KEV.
         FE-58 : MUGHABGHAB+/6/.
      FOR FE-56, A NEGATIVE LEVEL WAS ADDED AT -3.75 KEV WITH
      NEUTRON WIDTH OF 100 EV AND GAMMA WIDTH OF 1.0 EV.  NEUTRON
      WIDTH OF 27.67-KEV RESONANCE WAS TAKEN AS 1420 EV.

      CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS.
                     2200-M/S     RES. INTEG.
         ELASTIC      11.36  B         -
         CAPTURE       2.56  B        1.340 B
         TOTAL        13.92  B         -

MF=3  NEUTRON CROSS SECTIONS
      BELOW 250 KEV, BACKGROUND CROSS SECTIONS WERE GIVEN.

  MT=1    TOTAL
      FOR ENERGIES 250 KEV - 20 MEV, FINE RESOLUTION DATA WERE
      TAKEN BY EYE-GUIDE USING INTERACTIVE DISPLAY OF NDES
      NEUTRON DATA EVALUATION SYSTEM) DEVELOPED BY T.NAKAGAWA AT
      THE NUCLEAR DATA CENTER, JAERI.  THE FOLLOWING DATA WERE
      MAINLY ADOPTED:
           BELOW 500 KEV     : PATTENDEN+/12/
           500 KEV - 4.7MEV : CARLSON+/7/
           4.7 MEV - 12 MEV : CIERJACKS+/8/
      BY CONSIDERING EXPERIMENTAL RESOLUTION, CROSS SECTION SHAPE
      WAS MADE SHARPER.
  MT=2    ELASTIC SCATTERING
      GIVEN AS TOTAL MINUS NONELASTIC CROSS SECTIONS
  MT=3    NONELASTIC
      SUM OF MT=4,16,22,28,102,103,107
  MT=16,22,28,103
      CALCULATED USING GNASH /9/.
  MT=4,51-90,91  INELASTIC SCATTERING
      ISOTOPIC DATA WERE OBTAINED FROM THE CASTHY/10/ AND GNASH
      CALCULATIONS.  ISOTOPIC LEVELS WERE GROUPED INTO 25
      LEVELS OF NATURAL ELEMENT.  THE CONTRIBUTIONS FROM THE
      DIRECT PROCESS WERE INCLUDED IN THE LEVELS OF MT=55,58,
      64,66,68,69,88,90.
      OPTICAL POTENTIAL PARAMETERS USED IN THE CALCULATION ARE
      AS FOLLOWS:
           V  = 46.0-0.25*E                , R0=1.286, A0=0.620
           WS = 14.0-0.2*E                 , RS=1.390, AS=0.700
                14.8-0.2*E FOR FE-57
           VSO= 6.0                        , RSO=1.07 ,ASO=0.620
             ENERGIES IN MEV UNIT, LENGTHS IN FM UNIT.
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    *****  JENDL-3.2  ****************************************
    FOR MT=51, RESONANCE STRUCTURE OF FE-57 WAS TAKEN INTO
    ACCOUNT.
    MT=55 (1ST LEVEL OF FE-56)
      850 KEV - 2.15 MEV
        EVALUATED ON THE BASIS OF THE MEASUREMENTS/12,13/.
      2.15 MEV - 4.6 MEV
        MODIFIED BY CONSIDERING THE JENDL-2 DATA.
    MT=61,66,68,70 (2ND,3RD,4TH AND 5TH LEVELS OF FE-56)
      THESE CROSS SECTIONS WERE MODIFIED AROUNF THRESHOLD BY
      CONSIDERING THE MEASUREMENTS/14,15/.
    MT=68,70,76-79,81-85,88,91
      ABOVE 10 MEV, THESE CROSS SECTIONS WERE SLIGHTLY MODIFIED
      ACCORDING TO THE JENDL FUSION FILE/16/, WHICH WAS
      OBTAINED FROM SINCROS-II /17/ CALCULATIONS.
    *******************************************************

  MT=102  CAPTURE
     BACKGROUND CROSS SECTION WAS GIVEN BELOW 250 KEV.
     ABOVE 250 KEV, THE CASTHY CALCULATION WAS ADOPTED.
  MT=107      (N,ALPHA)
    FOR FE-56, THE EVALUATION WAS MADE ON THE BASIS OF
    EXPERIMENTAL DATA.  FOR FE-54,57,58, THE GNASH CALCULATION
    WAS ADOPTED.
  MT=251  MU-BAR
    CALCULATED WITH CASTHY /10/.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,51-90
    OPTICAL AND STATISTICAL-MODEL CALCULATIONS.
    THE C.C. CALCULATIONS WERE ADDED TO THE LEVELS OF MT=55,
    58,61,63,64,65,70,73,74.
  MT=16,22,28,91
    OBTAINED FROM JENDL FUSION FILE.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,22,28,91
    OBTAINED FROM JENDL FUSION FILE.

MF=12 PHOTON MULTIPLICITIES
  MT=3
    MULTIPLICITIES WERE CALCULATED USING GNASH.
  MT=102
    CALCULATED WITH CASTHY.

MF=13 PHOTON PRODUCTION CROSS SECTIONS
  MT=4,103,107
    BELOW 2.5 MEV, DISCRETE GAMMAS WERE GIVEN.

MF=14 PHOTON ANGULAR DISTRIBUTIONS
  MT=3,4,102,103,107
    ASSUMED TO BE ISOTROPIC.

MF=15 PHOTON ENERGY DISTRIBUTIONS
  MT=102
    BELOW 10 KEV, CALCULATED WITH CASTHY.
    ABOVE 10 KEV, BASED ON THE DATA OF IGASHIRA ET AL./11/.
  MT=3,103,107
    CALCULATED WITH GNASH.

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MAT number = 2625

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 26-FE- 54 JNDC       EVAL-MAR87 S.IIJIMA,H.YAMAKOSHI
                      DIST-SEP89 REV2-NOV93
 HISTORY
 87-03  EVALUATION WAS PERFORMED FOR JENDL-3.
 87-05  COMPILED BY K.SHIBATA (JAERI).
 93-11  JENDL-3.2
        THE CROSS SECTIONS FOR MT=54,55 WERE MODIFIED BY
        K. SHIBATA (JAERI).
        THE Q-VALUE OF MT=102 WAS CORRECTED.
        ANGULAR DISTRIBUTIONS FOR MT=16,22,28,91 WERE OBTAINED
        FROM THE JENDL FUSION FILE /8/ (KALBACH'S SYSTEMATICS).
        THE GAMMA PRODUCTION DATA WERE REEVALUATED BY S. IGARASI
        (NEDAC).
        DATA WERE COMPILED BY K. SHIBATA.
        ***** MODIFIED PARTS FOR JENDL-3.2 ******************
        (3,54),(3,55)          DIRECT COMPONENTS
        (3,102)                Q-VALUE CORRECTED
        (3,4)                  RECALCULATED
        (3,2)                  TOTAL - NONELASTIC
        (4,16),(4,22),(4,28),(4,91)
                               CONVERTED FROM JENDL FUSION FILE
        (12,28),(12,102),(12,103)
                               MULTIPLICITIES CORRECTED
        (15,102)               NEWLY CALCULATED BELOW 10 KEV
        ***************************************************

 MF=1  GENERAL INFORMATION
   MT=451  DESCRIPTIVE DATA AND DICTIONARY

 MF=2  RESONANCE PARAMETERS
   MT=151 RESOLVED RESONANCES
       RESONANCE REGION = 1.0E-5 EV TO 250.0 KEV
       THE MULTILEVEL BREIT-WIGNER FORMULA WAS USED.  PARAMETERS
       WERE ADOPTED MAINLY FROM PANDEY+/1/ BY ASSUMING THE AVERAGE
       RADIATIVE WIDTH TO BE 2.5 EV /2/.  R=5.6 FM WAS TAKEN FROM
       REF. /3/.

       CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS.
                        2200-M/S     RES. INTEG.
          ELASTIC       0.4929 B         -
          CAPTURE       2.156 B        1.33 B
          TOTAL         2.649 B          -

 MF=3  NEUTRON CROSS SECTIONS
       BELOW 250 KEV, BACKGROUND CROSS SECTIONS WERE GIVEN FOR THE
       TOTAL AND ELASTIC SCATTERING CROSS SECTIONS ON THE UPPER
       SIDE OF THE FIRST RESONANCE.  ABOVE 250 KEV, THE CROSS
       SECTIONS WERE EVALUATED AS FOLLOWS.
   MT=1    TOTAL
       SPHERICAL OPTICAL MODEL CALCULATION WAS MADE BY USING CODE
       CASTHY /4/.  OPTICAL POTENTIAL PARAMETERS ARE AS FOLLOWS:
            V  = 46.0-0.250*E         , R0=1.286, A0=0.620
            WS = 14.00-0.200*E        , RS=1.390, AS=0.700
            VSO= 6.00                 , RSO=1.070,ASO=0.620
                  (ENERGIES IN MEV, LENGTHS IN FM)
   MT=2    ELASTIC SCATTERING
       GIVEN AS TOTAL MINUS OTHER CROSS SECTIONS
   MT=16,22,28 (N,2N),(N,N'A),(N,N'P)
       CALCULATED USING THE GNASH CODE /5/.
   MT=4,51-69,91  INELASTIC SCATTERING
       BELOW 7 MEV, THE CROSS SECTIONS WERE CALCULATED USING
       CASTHY WITH WIDTH FLUCTUATION CORRECTIONS.
       ABOVE 7 MEV, THE GNASH CALCULATION WAS PERFORMED.
       FOR MT=51,52,53,55,59,68, THE DIRECT PROCESS
       COMPONENT WAS CONSIDERED BY THE C.C. THEORY.

       LEVEL SCHEME IS GIVEN AS FOLLOWS:

          NO.      ENERGY(MEV)  SPIN-PARITY
          G.S.       0.0          0 +
           1.        1.4082       2 +
           2.        2.5382       4 +
           3.        2.5613       0 +
           4.        2.9499       6 +
           5.        2.9590       2 +
           6.        3.1661       2 +
           7.        3.2952       4 +
           8.        3.3450       3 -
           9.        3.8338       4 +
          10.        4.0330       4 +
          11.        4.0472       4 +
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          12.       4.0720       3 +
          13.       4.2632       4 +
          14.       4.2961       0 +
          15.       4.5980       2 +
          16.       4.6550       2 +
          17.       4.7000       3 +
          18.       4.7800       3 -
          19.       4.9490       4 +
       CONTINUUM LEVELS WERE ASSUMED ABOVE 5.145 MEV.

  MT=102  CAPTURE
        CASTHY CALCULATION WAS ADOPTED.
  MT=103  (N,P)
        BELOW 2.5 MEV, BASED ON THE DATA OF PAULSEN AND WIDERA/6/.
        BETWEEN 2.5 AND 10 MEV, BASED ON THE DATA OF SMITH AND
        MEADOWS/7/.
        ABOVE 10 MEV, CALCULATED WITH GNASH.
  MT=107  (N,ALPHA)
       GNASH CALCULATION MULTIPLIED BY 0.94.
  MT=251  MU-BAR
       CALCULATED WITH CASTHY /4/.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,51-69
       OPTICAL AND STATISTICAL-MODEL CALCULATION.
       FOR MT=51,52,53,54,59,68, THE DIRECT-PROCESS COMPONENT
       WAS TAKEN INTO ACCOUNT BY THE C.C. THEORY.
  MT=16,22,28,91
       CONVERTED FROM THE FILE-6 OF THE JENDL FUSION FILE/8/.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,22,28,91
       CALCULATED WITH GNASH.

MF=12 PHOTON MULTIPLICITIES AND TRANSITION PROBABILITY ARRAYS
  MT=16,22,28,91,102,103,107
       MULTIPLICITIES WERE CALCULATED WITH GNASH.
       FOR MT=28,102,103, CORRECTIONS WERE MADE.
  MT=51-69
       TRANSITION PROBABILITY ARRAYS

MF=14 PHOTON ANGULAR DISTRIBUTIONS
  MT=16,22,28,51-69,91,102,103,107
       ASSUMED TO BE ISOTROPIC.

MF=15 PHOTON ENERGY DISTRIBUTIONS
  MT=16,22,28,91,102,103,107
       CALCULATED WITH GNASH.
  FOR MT=102, REPLACED WITH NEW CALCULATIONS BELOW 10 KEV.
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MAT number = 2631

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 26-FE- 56 JNDC        EVAL-MAR87 S.IIJIMA,H.YAMAKOSHI
                       DIST-SEP89 REV2-MAR94
 HISTORY
 87-03  EVALUATION WAS PERFORMED FOR JENDL-3.
 87-05  COMPILED BY K.SHIBATA (JAERI).
 ******JENDL-3.2 ******************************************
 93-07  MODFIFCATION WAS MADE FOR (3,51-55),(3,59),(3,91).
        FILES 4 AND 5 FOR MT=16,22,28,19 WERE OBTAINED FROM THE
        FILE-6 OF THE JENDL FUSION FILE /9/.
        DATA FOR (3,4) WERE RECONSTRUCTED.
        (3,2) = TOTAL - NONELASTIC
 93-11  DATA FOR (12,102) AND (15,102) WERE REEVALUATED BY
        S. IGARASI (NEDAC).
 94-03  AS FOR (3,2) AND (3,107), SMALL CROSS-SECTION VALUES
        WERE REPLACED WITH 0.0.
        DATA WERE COMPILED BY K. SHIBATA (JAERI).
 ************************************************************

 MF=1  GENERAL INFORMATION
   MT=451  DESCRIPTIVE DATA AND DICTIONARY

 MF=2  RESONANCE PARAMETERS
   MT=151 RESOLVED RESONANCES
       RESONANCE REGION = 1.0E-5 EV TO 250.0 KEV
       THE MULTILEVEL BREIT-WIGNER FORMULA WAS USED.  PARAMETERS
       WERE ADOPTED FROM THE EXPERIMENTAL DATA BY PEREY+ /1/.
       R=6.5 FM WAS SELECTED TO REPRODUCE THE 24-KEV WINDOW CROSS
       SECTION.  NEUTRON WIDTH OF 27.67-KEV RESONANCE WAS TAKEN AS
       1420 EV.  THE PARAMETERS OF THE 1.15-KEV RESONANCE WERE
       TAKEN FROM THE RESULT OF THE NEANDC TASK FORCE /2/.

       CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS.
                       2200-M/S      RES. INTEG.
          ELASTIC      12.46  B           -
          CAPTURE       2.813 B        1.446 B
          TOTAL        15.27  B           -

 MF=3  NEUTRON CROSS SECTIONS
       BELOW 250 KEV, BACKGROUND CROSS SECTIONS WERE GIVEN
       FOR THE TOTAL AND ELASTIC SCATTERING CROSS SECTIONS.
       ABOVE 250 KEV, CROSS SECTIONS WERE EVALUATED AS FOLLOWS.
   MT=1    TOTAL
       SPHERICAL OPTICAL MODEL CALCULATION WAS MADE BY USING
       CASTHY CODE /3/.  PARAMETERS ARE AS FOLLOWS.
            V  = 46.0-0.25*E              , R0=1.286, A0=0.620
            WS = 14.0-0.20*E              , RS=1.390, AS=0.700
            VSO= 6.0                      , RSO=1.07,ASO=0.620
                 (ENERGIES IN MEV, LENGTHS IN FM).
   MT=2    ELASTIC SCATTERING
       GIVEN AS TOTAL MINUS NONELASTIC CROSS SECTIONS.
   MT=16,22,28  (N,2N),(N,N'A),(N,N'P)
       CALCULATED WITH GNASH /4/.
   MT=4,51-77,91  INELASTIC SCATTERING
       THE CASTHY AND GNASH CALCULATIONS WERE ADOPTED FOR
       NEUTRON ENERGIES BELOW AND ABOVE 7 MEV, RESPECTIVELY.
       THE DIRECT-PROCESS COMPONENT WAS CONSIDERED FOR MT=
       51,52,53,54,77 BY THE C.C. THEORY.

       THE LEVEL SCHEME IS GIVEN AS FOLLOWS:
          NO.     ENERGY(MEV)  SPIN-PARITY
          G.S.      0.0           0 +
           1.       0.8468        2 +
           2.       2.0851        4 +
           3.       2.6576        2 +
           4.       2.9417        0 +
           5.       2.9600        2 +
           6.       3.1200        1 +
           7.       3.1229        4 +
           8.       3.3702        2 +
           9.       3.3884        6 +
          10.       3.4454        3 +
          11.       3.4493        1 +
          12.       3.6009        2 +
          13.       3.6019        2 +
          14.       3.6070        0 +
          15.       3.7480        2 +
          16.       3.7558        6 +
          17.       3.8320        2 +
          18.       3.8565        3 +
          19.       4.0940        3 +
          20.       4.1003        3 +
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          21.        4.1200        4 +
          22.        4.2982        4 +
          23.        4.3020        0 +
          24.        4.3950        3 +
          25.        4.4010        2 +
          26.        4.4584        3 +
          27.        4.5100        3 -
       CONTINUUM LEVELS WERE ASSUMED ABOVE 4.701 MEV.
       ***** JENDL-3.2 ****************************************
       FOR MF/MT=3/51 BETWEEN THRESHOLD AND 2.1 MEV, EVALUATED
       DATA WERE OBTAINED FROM HIGH RESOLUTION DATA OF VOSS ET
       AL. /7/ BY TAKING ACCOUNT OF GAMMA-RAY ANGULAR DISTRI-
       BUTIONS /8/.
       THE CROSS SECTIONS FOR MT=54,91 WERE REPLACED WITH THOSE
       CONTAINED IN THE JENDL FUSION FILE.
       AS FOR MT=59, A POINT AT 11.7 MEV WAS DELETED.
       FURTHERMORE, THE CROSS SECTIONS FOR MT=52-55 WERE MODI-
       FIED AROUND THRESHOLD BY CONSIDERING THE MEASUREMENTS
       /11,12/.
       *******************************************************

   MT=102  CAPTURE
       BELOW 250 KEV, NO BACKGROUND.
       THE CASTHY CALCULATION WAS ADOPTED
   MT=103  (N,P)
       BELOW 7 MEV, BASED ON THE DATA OF SMITH AND MEADOWS/5/.
       7 - 13 MEV, TAKEN FROM JENDL-2.
       13 - 16 MEV, BASED ON THE DATA OF IKEDA ET AL./6/
       16 - 20 MEV, TAKEN FROM JENDL-2.
   MT=107  (N,ALPHA)
       BASED ON EXPERIMENTAL DATA.
   MT=251  MU-BAR
       CALCULATED WITH CASTHY /3/.

 MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
   MT=2,51-77
       OPTICAL AND STATISTICAL-MODEL CALCULATIONS WERE ADOPTED.
       THE C.C. CALCULATIONS WERE ADDED TO THE LEVELS OF MT=51,52,
       53,54,77.
   MT=16,22,28,91
       OBTAINED FROM JENDL FUSION FILE (KALBACH'S SYSTEMATICS).

 MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
   MT=16,22,28,91
       OBTAINED FROM JENDL FUSION FILE (SINCROS-II/10/ CAL-
       CULATIONS).

 MF=12 PHOTON MULTIPLICITIES AND TRANSITION PROBABILITY ARRAYS
   MT=16,22,28,91,103,107
       MULTIPLICITIES WERE CALCULATED WITH GNASH.
   MT=102
       CALCULATED WITH CASTHY.

 MF=14 PHOTON ANGULAR DISTRIBUTIONS
   MT=16,22,28,51-77,91,102,103,107
       ASSUMED TO BE ISOTROPIC.

 MF=15 PHOTON ENERGY DISTRIBUTIONS
   MT=16,22,28,91,103,107
       CALCULATED WITH GNASH.
   MT=102
       CALCULATED WITH CASTHY.
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MAT number = 2634

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 26-FE- 57 JNDC       EVAL-MAR87 S.IIJIMA,H.YAMAKOSHI
                      DIST-SEP89 REV2-NOV93
 HISTORY
 87-03  EVALUATION WAS PERFORMED FOR JENDL-3.
 87-05  COMPILED BY K.SHIBATA (JAERI)>
 93-11  JENDL-3.2
        ANGULAR DISTRIBUTIONS FOR MT=16,22,28,91 WERE CONVERTED
        FROM THE FILE-6 OF THE JENDL FUSION FILE /5/ (KALBACH'S
        SYSTEMATICS)
        GAMMA PRODUCTION DATA FOR MT=102 WERE EVALUATED BY S.
        IGARASI (NEDAC).
        DATA WERE COMPILED BY K. SHIBATA (JAERI).
        ***** MODIFIED PARTS FOR JENDL-3.2 ********************
        (4,16),(4,22),(4,28),(4,91)
                      OBTAINED FROM JENDL FUSION FILE.
        (12,102),(15,102)
                      STATISTICAL MODEL CALCULATIONS.
        *****************************************************

 MF=1  GENERAL INFORMATION
   MT=451  DESCRIPTIVE DATA AND DICTIONARY

 MF=2  RESONANCE PARAMETERS
   MT=151 RESOLVED RESONANCES
       RESONANCE REGION = 1.0E-5 EV TO 200.0 KEV
       THE MULTILEVEL BREIT-WIGNER FORMULA WAS USED.  PARAMETERS
       WERE ADOPTED FROM ALLEN+/1/ FOR S-WAVE RESONANCES, AND
       BEER+/2/ FOR P-WAVE RESONANCES IN 0 - 185 KEV.

       CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS.
                       2200-M/S      RES. INTEG.
          ELASTIC       0.2021 B         -
          CAPTURE       2.462 B        1.43 B
          TOTAL         2.664 B          -

 MF=3  NEUTRON CROSS SECTIONS
       BELOW 200 KEV, BACKGROUND CROSS SECTION WAS GIVEN FOR
       THE TOTAL AND CAPTURE CROSS SECTIONS.
       ABOVE 200 KEV, THE DATA WERE EVALUATED AS FOLLOWS.

   MT=1    TOTAL
       SPHERICAL OPTICAL MODEL CALCULATION WAS MADE WITH CASTHY
       CODE /3/.  PARAMETERS ARE AS FOLLOWS,
            V  = 46.0-0.25*E              , R0=1.286, A0=0.620
            WS = 14.08-0.20*E             , RS=1.390. AS=0.700
            VSO= 6.00                     , RSO=1.07,ASO=0.620
                (ENERGIES IN MEV UNIT, LENGTHS IN FM UNIT)
   MT=2    ELASTIC SCATTERING
       GIVEN AS TOTAL MINUS NONELASTIC CROSS SECTIONS
   MT=3    NONELASTIC
       SUM OF MT=4,16,22,28,102,103,107.
   MT=16,22,28,103,107  (N,2N),(N,N'A),(N,N'P),(N,P),(N,A)
       CALCULATED WITH GNASH /4/.
   MT=4,51-71,91  INELASTIC SCATTERING
       THE CASTHY AND GNASH CALCULATIONS WERE ADOPTED FOR
       NEUTRON ENERGIES BELOW AND ABOVE 7 MEV, RESPECTIVELY.
       THE LEVEL SCHEME USED IS GIVEN AS FOLLOWS:
          NO.      ENERGY(MEV)   SPIN-PARITY
          G.S        0.0         1/2 -
           1.        0.0144      3/2 -
           2.        0.1365      5/2 -
           3.        0.3668      3/2 -
           4.        0.7064      5/2 -
           5.        1.0072      7/2 -
           6.        1.1978      9/2 -
           7.        1.2654      1/2 -
           8.        1.3562      7/2 -
           9.        1.6273      3/2 -
          10.        1.7254      3/2 -
          11.        1.9893      9/2 -
          12.        1.9910      1/2 -
          13.        2.1180      5/2 -
          14.        2.2189      5/2 +
          15.        2.3300      1/2 -
          16.        2.3560     11/2 -
          17.        2.4560      9/2 +
          18.        2.5053      5/2 +
          19.        2.5643      3/2 -
          20.        2.6000      5/2 +
          21.        2.6974      1/2 -
       CONTINUUM LEVELS WERE ASSUMED ABOVE 2.76 MEV.
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  MT=102  CAPTURE
       CALCULATED WITH CASTHY.
  MT=251  MU-BAR
      CALCULATED WITH CASTHY.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,51-71
      CASTHY CALCULATION
  MT=16,22,28,91
      OBTAINED FROM JENDL FUSION FILE (KALBACH'S SYSTEMATICS)

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,22,28,91
      CALCULATED WITH GNASH.

MF=12 PHOTON MULTIPLICITIES AND TRANSITION PROBABILITY ARRAYS
  MT=16,22,28,91,103,107
      MULTIPLICITIES WERE CALCULATED WITH GNASH.
  MT=102
      CALCULATED WITH CASTHY.

MF=14 PHOTON ANGULAR DISTRIBUTIONS
  MT=16,22,28,51-71,91,102,103,107
      ASSUMED TO BE ISOTOPIC.

MF=15 PHOTON ENERGY DISTRIBUTIONS
  MT=16,22,28,91,103,107
      CALCULATED WITH GNASH.
  MT=102
      CALCULATED WITH CASTHY.
```

REFERENCES


```
 1) ALLEN B.J. ET AL.: PROC. SPECIALIST MEETING ON NEUTRON
    DATA OF STRUCTURAL MATERIALS FOR FAST REACTORS, GEEL,
    P. 476 (1977).
 2) BEER H. AND SPENCER R.R.: KFK-2063 (1974).
 3) IGARASI S. : J. NUCL. SCI. TECHNOL., 12, 67 (1975).
 4) YOUNG P.G. AND ARTHUR E.D.: LA-6974 (1977).
 5) CHIBA S. ET AL.: JAERI-M 92-027, P.35 (1992).
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MAT number = 2637
 26-FE- 58 JNDC       EVAL-MAR87 S.IIJIMA,H.YAMAKOSHI
                      DIST-SEP89 REV2-OCT93
HISTORY
87-03  EVALUATION WAS PERFORMED FOR JENDL-3.
87-05  COMPILED BY K.SHIBATA (JAERI).
93-10  JENDL-3.2.
       RE-EVALUATION WAS MADE BY
         T.NAKAGAWA (NDC/JAERI): RESONANCE PARAMS, CROSS SECTIONS
         S.IGARASI (NEDAC): GAMMA-RAY PRODUCTION DATA BELOW 10 KEV
       COMPILED BY T.NAKAGAWA

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)
      (3,1), (3,2), (3,4), (3,51-91), (3,102)
      (4,16-28), (4,91)     TAKEN FROM JENDL FUSION FILE
      (12,102)
      (15,102)              BELOW 1 MEV
     ***********************************************************

     --------------------------------------------------------------
      JENDL FUSION FILE /1/  (AS OF AUG. 1993)
          EVALUATED B.YU (CIAE) AND S.CHIBA (NDC/JAERI)
          COMPILED BY B.YU.

            ALL OF CROSS SECTIONS WERE TAKEN FROM JENDL-3.  MF=6
        OF MT=16, 22, 28 AND 91 WERE CREATED WITH SINCROS-II /2/
        AND F15TOB/1/ PROGRAM.  KALBACH'S SYSTEMATICS /3/ WAS
        USED.  THE PRECOMPOUND/COMPOUND RATIO WAS TAKEN FROM THE
        SINCROS-II CALCULATION.
            OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED
        IN THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./2/.
        LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/4/.
     --------------------------------------------------------------


MF=1  GENERAL INFORMATION
  MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
  MT=151 RESOLVED RESONANCES
      RESONANCE REGION = 1.0E-5 EV TO 350.0 KEV
      THE MULTILEVEL BREIT-WIGNER FORMULA WAS USED.  PARAMETERS
      WERE DETERMINED ON THE BASIS OF DATA BY GARG ET AL./5/,
      KAEPPELER ET AL./6/, ALLEN AND MACKLIN/7/.

      CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS.
                      2200-M/S     RES. INTEG.
         ELASTIC       6.470 B          -
         CAPTURE       1.300 B        1.36 B
         TOTAL         7.770 B          -

MF=3  NEUTRON CROSS SECTIONS
  BELOW 350 KEV, NO BACKGROUND CROSS SECTIONS WERE GIVEN.
  ABOVE 350 KEV, THE DATA WERE EVALUATED AS FOLLOWS.

  MT=1,4,51-62,91,102  TOTAL, INELASTIC AND CAPTURE
      CALCULATED WITH OPTICAL AND STATISTICAL MODEL CODE CASTHY
      /8/.  OPTICAL POTENTIAL PARAMETERS/9/ ARE AS FOLLOWS:
         V  = 46.0-0.25*EN (MEV),
         WS = 14.0-0.2*EN  (MEV),  (IN THE GAUSSIAN FORM)
         WI = 0.125*E-0.0004*E**2 (MEV),
         VSO= 6.0          (MEV),
         R  = 1.286 (FM), A0 = 0.62  (FM)
         RS = 1.387 (FM), AS = 0.7   (FM)
         RSO= 1.07  (FM), ASO= 0.62  (FM)

     THE LEVEL SCHEME USED IS:
          NO.      ENERGY(MEV)  SPIN-PARITY
         G.S.       0.0          0 +
          1.        0.8108       2 +
          2.        1.6747       2 +
          3.        2.0765       4 +
          4.        2.1339       3 +
          5.        2.2581       0 +
          6.        2.6004       4 +
          7.        2.7819       1 +
          8.        2.8764       2 +
          9.        3.0840       2 +
         10.        3.1330       4 +
         11.        3.2330       2 +
         12.        3.2440       0 +
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        LEVELS ABOVE 3.389 MEV WERE ASSUMED TO BE OVERLAPPING.
        THE CAPTURE CROSS SECTION WAS NORMALIZED TO 3 MB AT 500
        KEV/10/.  DIRECT CAPTURE CROSS SECTION WAS CALCULATED
        WITH A SIMPLE FORMULA DERIVED BY BENZI AND REFFO/11/ AND
        ADDED TO THE CASTHY CALCULATION.
  MT=2    ELASTIC
       TOTAL CROSS SECTION - SUM OF PARTIAL CROSS SECTIONS
  MT=16,22,28,103,107 (N,2N),(N,N'A),(N,N'P),(N,P),(N,A)
       CALCULATED WITH GNASH /12/.
  MT=251   MU-BAR
       CALCULATED WITH CASTHY /8/.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,51-62
       CASTHY CALCULATION
  MT=16,22,28,91
       APPROXIMATELY TRANSLATED FROM THE DATA IN MF=6 OF JENDL
       FUSION FILE.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,22,28,91
       CALCULATED WITH GNASH.

MF=12 PHOTON MULTIPLICITIES AND TRASITION PROBABILITIES
  MT=16,22,28,91,103,107
       MULTIPLICITIES WERE CALCULATED WITH GNASH.
  MT=51-62
       TRANSITION PROBABILITIES WERE GIVEN.
  MT=102
       MULTIPLICITIES WERE CALCULATED FROM ENERGY BALANCE.

MF=14 PHOTON ANGULAR DISTRIBUTIONS
  MT=16,22,28,51-62,91,102,103,107
       ASSUMED TO BE ISOTROPIC.

MF=15 PHOTON ENERGY DISTRIBUTIONS
  MT=16,22,28,91,103,107
       CALCULATED WITH GNASH.
  MT=102
       BELOW 10 KEV, CALCULATED WITH CASTHY/8/. ABOVE 1 MEV, GNASH
       CALCULATION WAS ADOPTED.
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REFERENCES
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 2) YAMAMURO N.: JAERI-M 90-006 (1990).
 3) KALBACH C.: PHYS. REV., C37, 2350 (1988).
 4) ENSDF: EVALUATED NUCLEAR STRUCTURE DATA FILE, BNL/NNDC.
 5) GARG J.B. ET AL.: PHYS. REV., C18, 1141 (1978).
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 9) YAMAKOSHI H.: JAERI 1261, P.30 (1979).
10) TROFIMOV JU.N.: ATOMNAJA ENERGIJA, 58, 278 (1985).
11) BENZI V. AND REFFO G.: CCDN/NW/10 (1969).
12) YOUNG P.G. AND ARTHUR E.D.: LA-6974 (1977).
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MAT number = 2725

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 27-CO- 59 KHI        EVAL-AUG88 T.WATANABE
                      DIST-SEP89 REV2-APR94
HISTORY
88-08  NEWLY EVALUATED BY T.WATANABE
                          (KAWASAKI HEAVY INDUSTRIES, LTD.)
94-04 JENDL-3.2.
       GAMMA PRODCTION DATA EVALUATED BY T.ASAMI (DATA ENG.)
       OTHER DATA WERE MAINLY ADOPTED FROM JENDL FUSION FILE.
      COMPILED BY T.NAKAGAWA

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (3,4), (3,51-91), (4,16-91), (5,16-91)
             ADOPTED FROM JENDL FUSION FILE
      (3,102)
      (3,2)  TO COMPENSATE THE ABOVE CROSS SECTION CHANGES
      GAMMA-RAY PRODUCTION DATA: NEW EVALUATION
     ***********************************************************
     -------------------------------------------------------------
      JENDL FUSION FILE /1/  (AS OF NOV. 1993)
            EVALUATED BY B.YU (CIAE) AND S.CHIBA (NDC/JAERI)
            COMPILED  BY B.YU     .
         CROSS SECTIONS WERE MAINLY TAKEN FROM JENDL-3.1 EXCEPT
      FOR THE (N,N') (MT=51 TO 91) REACTIONS WHICH WERE TAKEN FROM
      NEW CALCULATION WITH SINCROS-II/2/.  ENERGY DISTRIBUTIONS
      FOR MT=16, 22, 28 AND 91 WERE REPLACED BY THE SINCROS-II
      CALCULATION.  DDX (MF=6) WERE CREATED WITH F15TOB PROGRAM
      /1/ IN WHICH MODIFIED KUMABE'S SYSTEMATICS /3/ WAS USED.
      THE RATIO OF PRECOMPOUND TO COMPOUND WAS TAKEN FROM THE
      SINCROS-II CALCULATION.  OPTICAL-MODEL, LEVEL DENSITY AND
      OTHER PARAMETERS USED IN THE SINCROS-II CALCULATION ARE
      DESCRIBED IN REF./2/.  LEVEL SCHEMES WERE DETERMINED ON THE
      BASIS OF ENSDF/4/.
     -------------------------------------------------------------


MF=1    GENERAL INFORMATION
  MT=451   DESCRIPTIVE DATA AND DICTIONARY

MF=2
  MT=151   RESONANCE PARAMETERS            : 1.0E-5 EV - 100 KEV
        RESOLVED RESONANCES FOR MLBW FORMULA:
           PARAMETERS WERE EVALUATED BASED ON EXPERIMENTAL DATA
           /5,6,7/ AND MODIFIED TO REPRODUCE EXPERIMENTAL TOTAL
           CROSS SECTIONS. NEGATIVE ENERGY LEVELS WERE ADDED TO
           REPRODUCE 2200 M/S TOTAL AND CAPTURE CROSS SECTIONS.

        CALCULATED 2200 M/S CROSS SECTIONS AND RESONANCE INTEGRALS
                        2200 M/SEC        RES. INTEG.
            ELASTIC        6.0  B             -
            CAPTURE       37.18 B           75.6 B
            TOTAL         43.19 B             -

MF=3    NEUTRON CROSS SECTIONS                     : ABOVE 100 KEV
  MT=1    TOTAL
    UP TO 4 MEV, BASED ON EXPERIMENTAL DATA /8,9/.  ABOVE 4 MEV,
    TOTAL CROSS SECTION WAS CALCULATED WITH OPTICAL AND
    STATISTICAL MODEL CODE CASTHY/10/.

    THE SPHERICAL OPTICAL POTENTIAL PARAMETERS WERE EVALUATED TO
    REPRODUCE EXPERIMENTAL TOTAL CROSS SECTIONS /8,11/.
           V = 49.65 - 0.114*EN MEV  R0= 1.241 FM  A0= 0.533 FM
           WS= 8.625-0.05306*EN MEV  RS= 1.421 FM  B = 0.292 FM
           VSO= 7.724 MEV            RSO=1.151 FM  ASO=0.7   FM

  MT=2   ELASTC SCATTERING
    TOTAL CROSS SECTION - SUM OF PARTIAL CROSS SECTIONS

  MT= 4, 51 - 70, 91  INELASTIC SCATTERING
    TAKEN FROM JENDL FUSION FILE.  THE LEVEL SCHEME WAS TAKEN FROM
    REF./4/  CONTRIBUTIONS OF THE DIRECT PROCESS WAS CALCULATED
    FOR THE LEVELS MARKED WITH '*'.

           NO.      ENERGY(MEV)    SPIN-PARITY (DIRECT PROCESS)
           G.S        0.0            7/2-
            1         1.0993         3/2-           *
            2         1.1905         9/2-           *
            3         1.2920         3/2-           *
            4         1.4343         1/2-
            5         1.4595        11/2-           *
            6         1.4820         5/2-           *
            7         1.7450         7/2-           *
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8	2.0630	5/2-	*
9	2.0880	7/2-	*
10	2.1460	7/2-	
11	2.1533	15/2-	
12	2.183	5/2-	
13	2.205	5/2-	*
14	2.3971	9/2-	
15	2.479	7/2-	
16	2.537	9/2-	
17	2.5405	3/2-	
18	2.5816	9/2+	
19	2.584	5/2-	
20	4.0	5/2-	*

LEVELS ABOVE 2.584 MEV WERE ASSUMED TO BE OVERLAPPING.

MT=16 (N,2N)
BASED ON EXPERIMENTAL DATA /12,13,14,15/ AND YAMAMURO'S THEORETICAL CALCULATIONS /16/.

MT=22,28,104 (N,N ALPHA),(N,NP),(N,D)
YAMAMURO'S EVALUATION WAS ADOPTED /16/.

MT=102 CAPTURE
STATISTICAL MODEL CALCULATION WITH CASTHY CODE /10/ WAS PERFORMED. ABOVE 800 KEV, EYE-GUIDED CURVE TO THE EXPERIMENTAL DATA /6,17,18,19/.

MT=103 (N,P)
BASED ON EXPERIMENTAL DATA /12,20,21,22/.

MT=107 (N,ALPHA)
JENDL-2 DATA WERE ADOPTED WITH SLIGHT MODIFICATION BASED ON EVAIN'S EVALUATION /23/ AND EXPERIMENTAL DATA /12,24/.

MT=251 MU-BAR
CALCULATED FROM THE DATA IN MF=4.

MF=4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=2
OPTICAL MODEL CALCULATION.
MT=16,22,28,51-70,91
ADOPTED FROM JENDL FUSION FILE.

MF=5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=16,22,28,91
ADOPTED FROM JENDL FUSION FILE.

MF=12 GAMMA-RAY PRODUCTION MUTIPLICITIES AND TRANSITION PROBABILITIES
MT=16,22,28,91,103,104,107
MULTIPLICITIES WERE CALCULATED WITH GNASH /25/
MT=51-68
TRANSITION PROBABILITIES WERE GIVEN.
MT=102
FROM ENERGY BALANCE.

MF=14 GAMMA-RAY ANGULAR DISTRIBUTIONS
MT=16,22,28,51-68,91,102,103,104,107
ISOTROPIC DISTRIBUTIONS WERE ASSUMED.

MF=15 GAMMA-RAY ENERGY DISTRIBUTIONS
MT=16,22,28,91,103,104,107
CALCULATED WITH GNASH /25/
MT=102
CALCULATED WITH CASTHY /10/ AT THERMAL ENERGY AND WITH GNASH ABOVE 100 KEV.

REFERENCES
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3) KUMABE, I. ET AL.: NUCL. SCI. ENG., 104, 280 (1990).
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25) YOUNG P.G. AND ARTHUR E.D.: LA-6974 (1977).

MAT number = 2800

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 28-NI-  0 NAIG       EVAL-MAR87 S.IIJIMA
                      DIST-SEP89 REV2-NOV93
HISTORY
87-03  EVALUATION WAS PERFORMED FOR JENDL-3.
87-05  COMPILED BY K.SHIBATA (JAERI).
93-11  JENDL-3.2
         GAMMA-RAY PRODUCTION DATA REVISED BY S.IGARASI (NEDAC).
         INELASTIC SCATTERING CROSS SECTIONS BY K.SHIBATA(JAERI).
       COMPILED BY T.NAKAGAWA (NDC/JAERI).

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (3,1)                557 KEV - 5 MEV
      (3,2)
      (3,4), (3,51-91)     RE-GROUPING INELASTIC SCATTERINGSIGS.
      (3,103), (3,111)      SLIGHT MODIFICATION
      (4,16) - (4,28), (4,91)  FROM JENDL FUSION FILE
      (5,16) - (5,91)          FROM JENDL FUSION FILE
      ALL GAMMA-RAY PRODUCTION DATA
     ***********************************************************

     -------------------------------------------------------------
      JENDL FUSION FILE /1/  (AS OF NOV. 1993)
            EVALUATED AND COMPILED BY S. CHIBA (NDC/JAERI)

       CROSS SECTIONS WERE TAKEN FROM JENDL-3.1.  HOWEVER, ENERGY
       DISTRIBUTIONS OF MT=16, 17, 22, 28 AND 91 WERE REPLACED BY
       THOSE CALCULATED WITH SINCROS-II SYSTEM/2/.  DDXS OF
       CONTINUUM REACTIONS WERE CREATED WITH F15TOB PROGRAM /1/.
       THE RATIO OF PRECOMPOUND TO COMPOUND WAS TAKEN FROM
       SINCROS-II CALCULATION.  KUMABE'S SYSTEMATICS/3/ WAS USED.
       OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED IN
       THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./2/.  LEVEL
       SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/4/.
     -------------------------------------------------------------


MF=1,MT=451   COMMENTS AND DICTIONARY

MF=2,MT=151   RESOLVED RESONANCE PARAMETERS : 1.0E-5 EV - 557 KEV
      CONSTRUCTED FROM RESONANCE PARAMETERS FOR 5 ISOTOPES WHICH
      WERE MAINLY BASED ON THE FOLLOWING DATA:

         NI-58   SYME ET AL./5/, JENDL-2/6/
         NI-60   PERY ET AL./7,8/
         NI-61   JENDL-2/6/, MOXON/9/
         NI-62   JENDL-2/6/
         NI-64   JENDL-2/6/

     CALCULATED 2200 M/S VALUES AND RESONANCE INTEGRALS (BARN):
                         2200 M/S VALUE        RES.INT.
           TOTAL           22.241                 -
           ELASTIC         17.859                 -
           CAPTURE          4.383               2.143

MF=3  NEUTRON CROSS SECTIONS
  BELOW 557 KEV, BACKGROUND CROSS SECTIONS APPLIED TO MT=1, 2 AND
  102.

  CROSS SECTIONS ABOVE RESONANCE REGION WERE EVALUATED AS FOLLOWS:

  MT=1 : TOTAL CROSS SECTION
     BASED ON THE HIGH-RESOLUTION DATA OF LARSON+/10/.  THE CROSS
     SECTION SHAPE WAS UNFOLDED BY CONSIDERING EXPERIMENTAL
     RESOLUTION.

  MT=2 : ELASTIC SCATTERING
     (TOTAL) - (NONELASTIC CROSS SECTIONS).

  MT=16,17,22,28,103,104,105,106,107,111: (N,2N),(N,3N),
     (N,N'A),(N,N'P),(N,P),(N,D),(N,T),(N,HE-3),(N,A),(N,2P)
     CONSTRUCTED FROM ISOTOPIC DATA.

  MT=4,51-70,91 : INELASTIC SCATTERING
     ISOTOPIC LEVELS WERE GROUPED INTO 20 LEVELS OF NATURAL
     ELEMENT.  THE CONTRIBUTIONS FROM THE DIRECT PROCESS WERE
     TAKEN INTO ACCOUNT FOR THE LEVELS OF MT=56, 59, 60, 61, 62,
     63, 69, 70.

  MT=102 : CAPTURE
     CALCULATED WITH THE STATISTICAL MODEL CODE CASTHY /11/.
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    MT=251   : MU-BAR
          CALCULATED WITH CASTHY /11/.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2                : CALCULATED WITH OPTICAL MODEL.
  MT=16,17,22,28,91 : TAKEN FROM JENDL FUSION FILE.
  MT=51-70           : CALCULATED WITH CASTHY.  THE DIRECT PROCESS
                        WAS CONSIDERED FOR MT=56,59,60,61,62,63,69,
                        70.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,22,28,91 : TAKEN FROM JENDL FUSION FILE.

MF=12 PHOTON MULTIPLICITIES
  MT=102 (BELOW 2 MEV)
    MULTIPLICITIES OBTAINED FROM ENERGY BALANCE.

MF=13 PHOTON PRODUCTION CROSS SECTIONS
  MT=3  (ABOVE 2 MEV)
    CONSTRUCTED FROM THE DATA OF NI-58 AND NI-60 CALCULATED WITH
    GNASH, AND FOLLOWING FACTOR WAS MULTIPLIED BETWEEN 2.0 AND
    18.0 MEV, BECAUSE THEY WERE TOO LOW COMPARED WITH EXPERIMENTS
    FROM 4.0 TO 16.0 MEV;
              F(E)=EXP(0.0042(E-2.0)(18.0-E)).
  MT=4 (BELOW 2 MEV)
    COMPOSITE DATA FROM LEVEL EXCITATION CROSS SECTIONS AND
    BRANCHING RATIOS OF 5 ISOTOPES BELOW 2.0 MEV.
  MT=103, 107 (BELOW 2 MEV)
    CALCULATED WITH GNASH.

MF=14 PHOTON ANGULAR DISTRIBUTIONS
  MT=3,4,102,103,107: ISOTROPIC

MF=15 PHOTON ENERGY DISTRIBUTIONS
  MT=3
    CALCULATED WITH GNASH.
  MT=102
    CALCULATED WITH CASTHY FOR 5 ISOTOPES, TAKING PRIMARY
    TRANSITIONS ON NI-58 AND 60, AT 1.0E-5, 2.53E-2, 1.0E+3 AND
    1.0E+4 EV.
  MT=103, 107
    CALCULATED WITH GNASH.
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MAT number = 2825
 28-NI- 58 NAIG       EVAL-MAR87 S.IIJIMA
                      DIST-SEP89 REV2-SEP93
HISTORY
87-03  EVALUATION WAS PERFORMED FOR JENDL-3. SHORT DESCRIPTION
       ON THE EVALUATION IS GIVEN IN REF./1/
87-05  COMPILED BY K.SHIBATA (JAERI).
90-10  MF=5, MT=16, 22 AND 28: DATA AT THRESHOLD ENERGIES WERE
       MODIFIED. MF=12, MT=16, 91 AND 102 WERE SLIGHTLY MODIFIED.
93-09  JENDL-3.2.
       COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (4,16-28), (4,91)     TAKEN FROM JENDL FUSION FILE
      (5,16-91)             TAKEN FROM JENDL FUSION FILE
      (12,102)              BELOW 500 KEV, REVISED BY S.IGASASI
      (15,102)              BELOW 500 KEV, REVISED BY S.IGARASI
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      JENDL FUSION FILE /2/  (AS OF SEP. 1993)
        EVALUATED BY S.CHIBA (NDC/JAERI)
        COMPILED BY S.CHIBA

          ALL OF CROSS SECTIONS WERE TAKEN FROM JENDL-3.  EDX'S OF
        MT=16, 22, 28 AND 91 WERE REPLACED BY THOSE CALCULATED
        WITH SINCROS-II CODE SYSTEM/3/ IN ORDER TO MAKE THE
        AGREEMENT WITH THE EDX OF NATURAL NI MEASURED BY BABA ET
        AL./4/ AT 14.1 MEV. DDX'S OF CONTINUUM REACTIONS WERE
        CREATED WITH F15TOB PROGRAM /2/.  KUMABE'S SYSTEMATICS
        /5/ WAS USED.  THE PRECOMPOUND/COMPOUND RATIO WAS
        CALCULATED BY THE SINCROS-II CODE SYSTEM.
          OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED
        IN THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./3/.
        LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/6/.
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MF=1,MT=451   COMMENTS AND DICTIONARY

MF=2,MT=151   RESOLVED RESONANCE PARAMETERS : 1.0E-5 EV - 420 KEV
        EVALUATION BASED ON THE FOLLOWING DATA.
           S-WAVE RESONANCE PARAMETERS FROM SYME+/7/
           P-WAVE RESONANCE PARAMETERS FROM JENDL-2 AND SYME+/7/
        TWO NEGATIVE RESONANCES DUE TO PEREY+/8/ WERE ADOPTED
        WITH MODIFICATION:
           E = -50  KEV   GAMMA-N = 28.0 KEV   GAMMA-G = 0.0
           E = -6.5 KEV   GAMMA-N = 1400  EV   GAMMA-G = 2.31 EV
        GAMMA WIDTH OF 2.0 EV AND 1.0 EV WERE ASSUMED FOR UNKNOWN
        GAMMA WIDTHS OF S-WAVE AND P-WAVE RESONANCES, RESPEC-
        TIVELY.
        SCATTERING RADIUS : 6.0 FM

      CALCULATED 2200 M/S VALUES AND RESONANCE INTEGRALS (BARN):
                         2200 M/S VALUE        RES. INT.
           TOTAL           30.754                 -
           ELASTIC         26.251                 -
           CAPTURE          4.503                2.16

MF=3  NEUTRON CROSS SECTIONS
  BACKGROUND CROSS SECTIONS APPLIED TO THE RESONANCE REGION FOR
  MT=1 AND 102.  CROSS SECTIONS ABOVE 420 KEV EVALUATED AS
  FOLLOWS:

     MT=1 : TOTAL CROSS SECTION
        BETWEEN 420 KEV TO 677 KEV, EXPERIMENTAL DATA OF FARREL ET
        AL./9/ WERE ADOPTED.  FROM 677 KEV TO 20 MEV, CALCULATED
        WITH OPTICAL MODEL.  POTENTIAL PARAMETERS WERE OBTAINED BY
        FITTING NAT-NI DATA /10/:
          V =51.33 - 0.331*EN ,WS=8.068 + 0.112*EN ,VSO=7.0 (MEV)
          R0=RS0=1.24         ,RS=1.40                      (FM)
          A0=AS0=0.541        ,AS=0.4                       (FM)
        SURFACE IMAGINARY PART IS IN DERIVATIVE WOODS-SAXON FORM.

     MT=2 : ELASTIC SCATTERING
        (TOTAL) - (NONELASTIC CROSS SECTIONS).

     MT=3 : NONELASTIC CROSS SECTION
        SUM OF MT=4,16,22,28,102,103,104,105,106,107,111.

     MT=16  (N,2N)
        MAINLY BASED ON EXPERIMENTAL DATA OF IKEDA ET AL./11/ AND
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      PAVLIK ET AL./12/

   MT=28  (N,N'P)
      OBTAINED BY SUBTRACTIONG THE (N,D) CROSS SECTION CALCULA-
      TED WITH PEGASUS FROM THE (N,NP+PN+D)CO-57 CROSS SECTION
      BASED ON IKEDA ET AL./11/ AND PAVLIK ET AL./12/ INVERSE
      CROSS SECTIONS WERE CALCULATED FROM THE FOLLOWING OMP'S:
            PROTON   = PEREY/13/
            ALPHA    = HUIZENGA AND IGO/14/
            DEUTERON = LOHR AND HAEBERLI/15/
            HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/16/

   MT=22  (N,N'A)
      CALCULATED USING THE PEGASUS CODE /17/ AND NORMALIZED TO
      EXPERIMENTAL DATA/18/

   MT=4,51-65,91     INELASTIC SCATTERING
      THE CASTHY /19/ AND GNASH /20/ CALCULATION WAS ADOPTED IN
      THE NEUTRON ENERGY REGION BELOW AND ABOVE 7 MEV, RESPEC-
      TIVELY.  THE DIRECT PROCESS WAS TAKEN INTO ACCOUNT FOR MT=
      51, 52, 53, 55 AND 65.  FOR THE LEVEL OF MT=65, ONLY THE
      DIRECT PROCESS WAS CONSIDERED.  THE LEVEL SCHEME USED IS
      GIVEN AS FOLLOWS:

                  NO  ENERGY(MEV)  SPIN-PARITY
                  G.S    0.0          0 +
                   1.    1.4545       2 +
                   2.    2.4591       4 +
                   3.    2.7755       2 +
                   4.    2.9018       1 +
                   5.    2.9424       0 +
                   6.    3.0376       2 +
                   7.    3.2634       2 +
                   8.    3.4203       3 +
                   9.    3.5240       4 +
                  10.    3.5309       0 +
                  11.    3.5934       1 +
                  12.    3.6200       4 +
                  13.    3.7744       3 +
                  14.    3.8983       2 +
                  15.    4.4753       3 -
             CONTINUUM LEVELS ASSUMED ABOVE 3.932 MEV.

   MT=102   CAPTURE
      CALCULATED WITH CASTHY.  THE GAMMA-RAY STRENGTH FUNCTION
      OF 4.616E-5 WAS USED.  LEVEL DENSITY PARAMETERS ARE:
                                PAIRING    SPIN-CUTOFF F.
         A(1/MEV) T(MEV) ENERGY(MEV)   (MEV**0.5)    EX(MEV)
  -------------------------------------------------------------
     NI-58   6.850   1.30    2.47         5.726        9.610
     NI-59   7.126   1.325   1.20         5.907        9.250
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   MT=103   (N,P)
      JENDL-2 WAS MODIFIED BY CONSIDERING EXPERIMENTAL DATA;
      BELOW 2 MEV, DATA OF SMITH ET AL./21/, AND ABOVE 13 MEV 2
      MEV), DATA OF IKEDA ET AL./11/ AND PAVLIK ET AL./12/
      PEGASUS CALCULATION WAS ALSO CONSIDERED ABOVE 15 MEV.

   MT=104,105,106,107,111   (N,D),(N,T),(N,HE-3),(N,A),(N,2P)
      THE CROSS SECTIONS WERE CALCULATED USING THE PEGASUS
      CODE /17/. THE (N,T) AND (N,A) CROSS SECTION WAS
      NORMALIZED TO THE DATA OF QAIM AND STOECKLIN/22/ AND
      GRIMES ET AL./18/, RESPECTIVELY.

   MT=251  : MU-BAR
      CALCULATED WITH OPTICAL MODEL.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2            : CALCULATED WITH OPTICAL MODEL.
  MT=51-64        : CALCULATED WITH CASTHY.  DIRECT PROCESS
                    INCLUDED IN MT=51, 52, 53, 55.
  MT=65           : C.C. CALCULATION.
  MT=16,22,28,91  : APPROXIMATELY TRANSFORMED FROM THE MF=6 DATA
                    (DDX) OF JENDL FUSION FILE.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,22,28,91  : APPROXIMATELY TRANSFORMED FROM THE MF=6 DATA
                    (DDX) OF JENDL FUSION FILE.

MF=12 PHOTON MULTIPLICITIES AND TRANSITION PROBABILITY ARRAYS
  MT=16,22,28,91,103,107:
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               MULTIPLICITIES CALCULATED WITH GNASH.
  MT=51-65 : TRANSITION PROBABILITY ARRAYS.
  MT=102   : MULTIPLICITIES CALCULATED FROM ENERGY BALANCE.

MF=14 PHOTON ANGULAR DISTRIBUTIONS
  MT=16,22,28,51-65,91,102,103,107:
               ISOTROPIC DISTRIBUTIONS.

MF=15 PHOTON ENERGY DISTRIBUTIONS
  MT=16,22,28,91,102,103,107:
                CALCULATED WITH GNASH. FOR MT=102, SPECTRA WERE
                CALCULATED WITH CASTHY, TAKING PRIMARY TRANSITIONS
                AT 1.0E-5, 2.53E-2, 1.0E+3 AND 1.0E+4 EV.
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22) QAIM S.M. AND STOECKLIN G.: NUCL. PHYS., A257, 233 (1976).
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MAT number = 2831

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 28-NI- 60 NAIG       EVAL-MAR87 S.IIJIMA
                      DIST-SEP89 REV2-SEP93
HISTORY
87-03  EVALUATION WAS PERFORMED FOR JENDL-3. SHORT DESCRIPTION
       ON THE EVALUATION IS GIVEN IN REF./1/
87-05  COMPILED BY K.SHIBATA (JAERI).
90-10  MF=5, MT=16, 22 AND 28: DATA AT THRESHOLD ENERGIES WERE
       MODIFIED. MF=12, MT=16, 91 AND 102 WERE SLIGHTLY MODIFIED.
93-09  JENDL-3.2.
       COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   *******************
      (4,16-28), (4,91)     TAKEN FROM JENDL FUSION FILE
      (5,16-91)             TAKEN FROM JENDL FUSION FILE
      (12,102)              BELOW 500 KEV, REVISED BY S.IGASASI
      (15,102)              BELOW 500 KEV, REVISED BY S.IGARASI
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      JENDL FUSION FILE /2/  (AS OF SEP. 1993)
        EVALUATED BY S.CHIBA (NDC/JAERI)
        COMPILED BY S.CHIBA

          ALL OF CROSS SECTIONS WERE TAKEN FROM JENDL-3.1.  EDX'S
        OF MT=16, 22, 28 AND 91 WERE REPLACED BY THOSE CALCULATED
        WITH SINCROS-II CODE SYSTEM/3/ BECAUSE NORMALIZATION
        ERRORS WERE FOUND IN THE DATA STORED IN JENDL-3.1.  DDX'S
        OF CONTINUUM REACTIONS WERE CREATED WITH F15TOB PROGRAM
        /2/.  KUMABE'S SYSTEMATICS /4/ WAS USED.  THE PRECOM-
        POUND/COMPOUND RATIO WAS CALCULATED BY THE SINCROS-II CODE
        SYSTEM.
          OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED
        IN THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./3/.
        LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/5/.
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MF=1,MT=451   COMMENTS AND DICTIONARY

MF=2,MT=151   RESOLVED RESONANCE PARAMETERS : 1.0E-5 EV - 456 KEV
        EVALUATION BASED ON THE FOLLOWING DATA.
           PARAMETERS IN JENDL-2 WERE MODIFIED WITH THE DATA OF
           PEREY ET AL./6/  TWO NEGATIVE RESONANCES WERE ADDED.
             E = -50 KEV  GAMMA-N = 12.8 KEV   GAMMA-G = 0.0 EV
             E = -656 EV  GAMMA-N = 0.60  EV   GAMMA-G = 6.0 EV

       CALCULATED 2200 M/S VALUES AND RESONANCE INTEGRALS (BARN):
                           2200 M/S VALUE        RES. INT.
           TOTAL             4.316                  -
           ELASTIC           1.416                  -
           CAPTURE           2.900                1.467

MF=3  NEUTRON CROSS SECTIONS
  NO BACKGROUND CROSS SECTIONS ARE GIVEN BELOW 456 KEV FOR MT=1,
  2, 102.  CROSS SECTIONS ABOVE 456 KEV WERE EVALUATED AS FOLLOWS:

     MT=1 : TOTAL CROSS SECTION
        HIGH RESOLUSION EXPERIMENTAL DATA OF PEREY ET AL./6/ WERE
        TRACED UP TO 1.6 MEV, AND THOSE BY STOLER ET AL./7/
        BETWEEN 1.6 AND 2.3 MEV.  ABOVE 2.3 MEV, CROSS SECTION WAS
        CALCULATED WITH OPTICAL MODEL.  POTENTIAL PARAMETERS WERE
        OBTAINED BY FITTING NAT-NI DATA /8/.  THE DATA MEASURED BY
        STOLER ET AL./7/ ARE REPRODUCED WELL WITH THIS SET OF OMP.
          V =51.33 - 0.331*EN ,WS=8.068 + 0.112*EN ,VSO=7.0 (MEV)
          R0=RS0=1.24          ,RS=1.40                     (FM)
          A0=AS0=0.541         ,AS=0.4                      (FM)
        SURFACE IMAGINARY PART IS IN DERIVATIVE WOODS-SAXON FORM.

     MT=2 : ELASTIC SCATTERING
        (TOTAL) - (NONELASTIC CROSS SECTIONS).

     MT=3 : NONELASTIC CROSS SECTION
        SUM OF MT=4,16,22,28,102,103,104,105,106,107,111.

     MT=16     : (N,2N)
        CALCULATED WITH GNASH/9/.

     MT=22,28,104,105,106,107,111: (N,N'A),(N,N'P),(N,D),
                                   (N,T),(N,HE-3),(N,A),(N,2P)
        THE CROSS SECTIONS WERE CALCULATED WITH PEGASUS/10/.  THE
        (N,A), (N,NA) AND (N,D) CROSS SECTIONS WERE NORMALIZED TO
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THE DATA OF GRIMES ET AL./11/ AND THE (N,T) WAS TO THE DATA OF QAIM AND STOECKLIN/12/. INVERSE CROSS SECTIONS WERE CALCULATED FROM THE FOLLOWING OMP'S:

PROTON = PEREY/13/
ALPHA = HUIZENGA AND IGO/14/
DEUTERON = LOHR AND HAEBERLI/15/
HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/16/

MT=4,52-61,91 : INELASTIC SCATTERING
THE CASTHY /17/ AND GNASH /9/ CALCULATIONS WERE ADOPTED FOR NEUTRON ENERGIES BELOW AND ABOVE 7 MEV, RESPECTIVELY. THE CONTRIBUTION FROM THE DIRECT PROCESS WAS INCLUDED FOR MT=51, 52, 53, 54, 61. FOR THE LEVEL OF MT=61, ONLY THE DIRECT PROCESS WAS CONSIDERED. THE LEVEL SCHEME USED IS AS FOLLOWS:

NO	ENERGY(MEV)	SPIN-PARITY
G.S	0.0	0 +
1.	1.3325	2 +
2.	2.1588	2 +
3.	2.2849	0 +
4.	2.5058	4 +
5.	2.6260	3 +
6.	3.1198	4 +
7.	3.1240	2 +
8.	3.1861	3 +
9.	3.1941	1 +
10.	3.2696	2 +
11.	4.0397	3 -

CONTINUUM LEVELS ASSUMED ABOVE 3.318 MEV.

MT=102 : CAPTURE
CALCULATED WITH CASTHY BY NORMALIZING TO 8.0 MB ANT 700 KEV /6/. GAMMA-RAY STRENGTH FUNCTION IS 2.925E-5. LEVEL DENSITY PARAMETERS ARE:

	A(1/MEV)	T(MEV)	PAIRING ENERGY(MEV)	SPIN-CUTOFF F. (MEV**0.5)	EX(MEV)
NI-60	7.700	1.15	2.47	6.209	8.75
NI-61	8.355	1.15	1.20	6.540	8.39

MT=103 : (N,P)
MOST OF DATA WERE TAKEN FROM JENDL-2 WHICH REPRODUCES WELL THE DATA OF PAULSEN ET AL./18/, AND MODIFIED BELOW 6 MEV AND AROUND 14.5 MEV BASED ON EXPERIMENTAL DATA AND GNASH CALCULATION.

MT=251 : MU-BAR
CALCULATED WITH OPTICAL MODEL.

MF=4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=2 : CALCULATED WITH OPTICAL MODEL.
MT=16,22,28,91: APPROXIMATELY TRANSFORMED FROM THE MF=6 DATA (DDX) OF JENDL FUSION FILE.
MT=51-60 : CALCULATED WITH CASTHY. DIRECT PROCESS INCLUDED IN MT=51, 52, 53, 54
MT=61 : C.C. CALCULATION.

MF=5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=16,22,28,91: APPROXIMATELY TRANSFORMED FROM THE MF=6 DATA (DDX) OF JENDL FUSION FILE.

MF=12 PHOTON MULTIPLICITIES AND TRANSITION PROBABILITY ARRAYS
MT=16,22,28,91,103,107:
MULTIPLICITIES CALCULATED WITH GNASH.
MT=102 : MULTIPLICITIES CALCULATED FROM ENERGY BALANCE.
MT=51-61 : TRANSITION PROBABILITY ARRAYS

MF=14 PHOTON ANGULAR DISTRIBUTIONS
MT=16,22,28,51-61,91,102,103,107
ISOTROPIC DISTRIBUTIONS.

MF=15 PHOTON ENERGY DISTRIBUTIONS
MT=16,22,28,91,102,103,107:
CALCULATED WITH GNASH. FOR MT=102, SPECTRA AT 1.0E-5, 2.53E-2, 1.0E+3 AND 1.0E+4 EV WERE CALCULATED WITH CASTHY, TAKING PRIMARY TRANSITIONS.

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MAT number = 2834

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 28-NI- 61 NAIG        EVAL-MAR87 S.IIJIMA
                       DIST-SEP89 REV2-SEP93
HISTORY
87-03  EVALUATION WAS PERFORMED FOR JENDL-3. SHORT DESCRIPTION
       ON THE EVALUATION IS GIVEN IN REF./1/
87-05  COMPILED BY K.SHIBATA (JAERI).
90-10  MF=5: DATA AT THRESHOLD ENERGIES WERE MODIFIED.
93-09  JENDL-3.2.
       COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (4,16-28), (4,91)     TAKEN FROM JENDL FUSION FILE
      (5,16-91)             TAKEN FROM JENDL FUSION FILE
     ***********************************************************

     -------------------------------------------------------------
      JENDL FUSION FILE /2/  (AS OF SEP. 1993)
        EVALUATED BY S.CHIBA (NDC/JAERI)
        COMPILED BY S.CHIBA

          CROSS SECTIONS WERE TAKEN FROM JENDL-3.1.  EDX'S OF
        MT=16, 22, 28 AND 91 WERE REPLACED BY THOSE CALCULATED
        WITH SINCROS-II CODE SYSTEM/3/ BECAUSE NORMALIZATION
        ERRORS WERE FOUND IN THE DATA STORED IN JENDL-3.1.  DDX'S
        OF CONTINUUM REACTIONS WERE CREATED WITH F15TOB PROGRAM
        /2/ WHERE KUMABE'S SYSTEMATICS /4/ WAS USED.  THE
        PRECOMPOUND/COMPOUND RATIO WAS CALCULATED BY THE
        SINCROS-II CODE SYSTEM.
          OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED
        IN THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./3/.
        LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/5/.
     -------------------------------------------------------------


MF=1,MT=451   COMMENTS AND DICTIONARY

MF=2,MT=151   RESOLVED RESONANCE PARAMETERS : 1.0E-5 EV - 57.0KEV
        PARAMETERS WERE TAKEN FROM JENDL-2 EXCEPT THAT THE NEUTRON
        WIDTH OF THE 64.07-KEV S-WAVE RESONANCE WAS CHANGED FROM
        54.0 EV TO 535 EV /6/.
        SCATTERING RADIUS: 6.4 FM

       CALCULATED 2200 M/S VALUES AND RESONANCE INTEGRALS (BARN):
                          2200 M/S VALUE        RES.INT
           TOTAL            11.239                -
           ELASTIC           8.731                -
           CAPTURE           2.509               2.44

MF=3  NEUTRON CROSS SECTIONS
  BACKGROUND CROSS SECTIONS WERE APPLIED TO THE RESONANCE REGION.
  CROSS SECTIONS ABOVE 57.0 KEV WERE EVALUATED AS FOLLOWS :

     MT=1 : TOTAL CROSS SECTION
        HIGH-RESOLUTION EXPERIMENTAL DATA/7/ WERE ADOPTED BETWEEN
        57 KEV AND 74.6 KEV.  ABOVE 74.6 KEV UP TO 20 MEV, THE
        OPTICAL-MODEL CALCULATION WAS PERFORMED.  POTENTIAL
        PARAMETERS WERE OBTAINED BY FITTING NAT-NI DATA/8/:
          V =51.33 - 0.331*EN ,WS=8.068 + 0.112*EN ,VSO=7.0 (MEV)
          R0=RS0=1.24         ,RS=1.40                      (FM)
          A0=AS0=0.541        ,AS=0.4                       (FM)
        SURFACE IMAGINARY PART IS IN DERIVATIVE WOODS-SAXON FORM.

     MT=2 : ELASTIC SCATTERING
        (TOTAL) - (NONELASTIC CROSS SECTIONS).

     MT=3 : NONELASTIC CROSS SECTION
        SUM OF MT=4,16,22,28,102,103,104,105,106,107,111.

     MT=16,22,28,103,104,105,106,107,111  (N,2N),(N,N'A),(N,N'P),
                         (N,P),(N,D),(N,T),(N,HE-3),(N,A),(N,2P)
        CALCULATED WITH PEGASUS/9/.  INVERSE CROSS SECTIONS
        WERE CALCULATED FROM THE FOLLOWING OMP'S:
              PROTON   = PEREY/10/
              ALPHA    = HUIZENGA AND IGO/11/
              DEUTERON = LOHR AND HAEBERLI/12/
              HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/13/

     MT=4,51-70,91,102 : INELASTIC SCATTERING AND CAPTURE
        CALCULATED WITH THE STATISTICAL MODEL CODE CASTHY /14/.
        THE LEVEL SCHEME USED/15/ IS AS FOLLOWS:
              NO  ENERGY(MEV) SPIN-PARITY
```

G.S	0.0	3/2 -
1.	0.0674	5/2 -
2.	0.2830	1/2 -
3.	0.6560	3/2 -
4.	0.9088	5/2 -
5.	1.0150	7/2 -
6.	1.1000	3/2 -
7.	1.1323	5/2 -
8.	1.1857	3/2 -
9.	1.4580	7/2 -
10.	1.6100	5/2 -
11.	1.7298	3/2 -
12.	1.8080	7/2 -
13.	1.9780	9/2 +
14.	1.9970	3/2 -
15.	2.0030	7/2 -
16.	2.0190	7/2 -
17.	2.1140	9/2 +
18.	2.1230	1/2 -
19.	2.4100	5/2 -
20.	2.4660	7/2 -

CONTINUUM LEVELS ASSUMED ABOVE 2.528 MEV. THE GAMMA-RAY STRENGTH FUNCTION OF 4.65E-4 WAS OBTAINED FROM THE CAPTURE CROSS SECTION DATA OF ERNST ET AL./16/ LEVEL DENSITY PARAMETERS ARE:

	A(1/MEV)	T(MEV)	PAIRING ENERGY(MEV)	SPIN-CUTOFF F. (MEV**0.5)	EX(MEV)
NI-61	8.355	1.15	1.20	6.540	8.390
NI-62	8.215	1.13	2.61	6.555	9.280

MT=251 : MU-BAR
CALCULATED WITH OPTICAL MODEL.

MF=4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=2 : CALCULATED WITH OPTICAL MODEL.
MT=16,22,28,91: APPROXIMATELY TRANSFORMED FROM THE MF=6 DATA (DDX) OF JENDL FUSION FILE.
MT=51-70 : 90 DEGREE SYMMETRIC IN THE CENTER-OF-MASS SYSTEM, CALCULATED WITH CASTHY.

MF=5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=16,22,28,91: APPROXIMATELY TRANSFORMED FROM THE MF=6 DATA (DDX) OF JENDL FUSION FILE.

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5) ENSDF: EVALUATED NUCLEAR STRUCTURE DATA FILE, BNL/NNDL.
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7) CHO M. ET AL.: PROC. 2ND INT. CONF. NUCL. DATA FOR REACTORS, HELSINKI, 1970, VOL.1, P.619 (1970).
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MAT number = 2837
 28-NI- 62 NAIG       EVAL-MAR87 S.IIJIMA
                      DIST-SEP89 REV2-SEP93
HISTORY
87-03  EVALUATION WAS PERFORMED FOR JENDL-3. SHORT DESCRIPTION
       ON THE EVALUATION IS GIVEN IN REF./1/
87-05  COMPILED BY K.SHIBATA (JAERI).
90-10  MF=5: DATA AT THRESHOLD ENERGIES WERE MODIFIED.
93-09  JENDL-3.2.
       COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (4,16-28), (4,91)    TAKEN FROM JENDL FUSION FILE
      (5,16-91)            TAKEN FROM JENDL FUSION FILE
     ***********************************************************

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      JENDL FUSION FILE /2/  (AS OF SEP. 1993)
        EVALUATED BY S.CHIBA (NDC/JAERI)
        COMPILED BY S.CHIBA

          CROSS SECTIONS WERE TAKEN FROM JENDL-3.1.  EDX'S OF
        MT=16, 22, 28 AND 91 WERE REPLACED BY THOSE CALCULATED
        WITH SINCROS-II CODE SYSTEM/3/ BECAUSE NORMALIZATION
        ERRORS WERE FOUND IN THE DATA STORED IN JENDL-3.1.  DDX'S
        OF CONTINUUM REACTIONS WERE CREATED WITH F15TOB PROGRAM
        /2/ IN WHICH KUMABE'S SYSTEMATICS /4/ WAS USED.  THE
        PRECOMPOUND/COMPOUND RATIO WAS CALCULATED BY THE SINCROS-
        II CODE SYSTEM.
          OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED
        IN THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./3/.
        LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/5/.
     -------------------------------------------------------------


MF=1,MT=451   COMMENTS AND DICTIONARY

MF=2,MT=151   RESOLVED RESONANCE PARAMETERS : 1.0E-5 EV - 557 KEV
        PARAMETERS WERE TAKEN FROM JENDL-2.
        SCATTERING RADIUS: 6.2 FM

       CALCULATED 2200 M/S VALUES AND RESONANCE INTEGRALS (BARN):
                          2200 M/S VALUE        RES.INT
           TOTAL            23.704                -
           ELASTIC           9.505                -
           CAPTURE          14.199              6.91

MF=3  NEUTRON CROSS SECTIONS
  BACKGROUND CROSS SECTIONS WERE APPLIED TO THE RESONANCE REGION.
  CROSS SECTIONS ABOVE 557 KEV WERE EVALUATED AS FOLLOWS :

     MT=1 : TOTAL CROSS SECTION
        EXPERIMENTAL DATA OF FARRELL ET AL./6/ WERE ADOPTED
        BETWEEN 557 KEV AND 670 KEV.  ABOVE 670 KEV UP TO 20 MEV,
        THE OPTICAL-MODEL CALCULATION WAS PERFORMED.  POTENTIAL
        PARAMETERS OBTAINED BY FITTING NAT-NI DATA/7/:
          V =51.33 - 0.331*EN ,WS=8.068 + 0.112*EN ,VSO=7.0 (MEV)
          R0=RSO=1.24         ,RS=1.40                      (FM)
          A0=ASO=0.541        ,AS=0.4                       (FM)
        SURFACE IMAGINARY PART IS IN DERIVATIVE WOODS-SAXON FORM.

     MT=2 : ELASTIC SCATTERING
        (TOTAL) - (NONELASTIC CROSS SECTION).

     MT=3 : NONELASTIC CROSS SECTION
        SUM OF MT=4,16,22,28,102,103,104,105,106,107,111.

     MT=16,22,28,103,104,105,106,111  (N,2N),(N,N'A),(N,N'P),
      (N,P),(N,D),(N,T),(N,HE-3),(N,2P)
        CALCULATED WITH PEGASUS/8/.  INVERSE CROSS SECTIONS WERE
        CALCULATED FROM THE FOLLOWING OMP'S:
              PROTON   = PEREY/9/
              ALPHA    = HUIZENGA AND IGO/10/
              DEUTERON = LOHR AND HAEBERLI/11/
              HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/12/

     MT=4,51-71,91,102 : INELASTIC SCATTERING AND CAPTURE
        CALCULATED WITH THE STATISTICAL-MODEL CODE CASTHY/13/ BY
        CONSIDERING THE SUM OF OTHER THRESHOLD REACTIONS AS
        COMPETING PROCESSES.  THE LEVEL SCHEME/14/ USED IS GIVEN
        AS FOLLOWS:
              NO  ENERGY(MEV) SPIN-PARITY
```

G.S	0.0	0 +
1.	1.1729	2 +
2.	2.0486	0 +
3.	2.3018	2 +
4.	2.3364	4 +
5.	2.8912	0 +
6.	3.0582	2 +
7.	3.1580	2 +
8.	3.1765	4 +
9.	3.2577	2 +
10.	3.2620	4 +
11.	3.2699	2 +
12	3.2774	4 +
13.	3.3703	1 +
14.	3.4620	4 +
15.	3.4860	0 +
16.	3.5185	2 +
17.	3.5229	3 +
18.	3.7570	3 -
19.	3.8493	1 +
20.	3.8530	2 +
21.	3.8600	2 +

CONTINUUM LEVELS ASSUMED ABOVE 3.967 MEV. THE GAMMA-RAY STRENGTH FUNCTION OF 1.379E-5 WAS OBTAINED FROM THE CAPTURE CROSS SECTION DATA OF BEER AND SPENCER/15/.
LEVEL DENSITY PARAMETERS ARE:

	A(1/MEV)	T(MEV)	PAIRING ENERGY(MEV)	SPIN-CUTOFF F. (MEV**0.5)	EX(MEV)
NI-62	8.215	1.13	2.61	6.552	9.280
NI-63	9.666	0.985	1.20	7.187	7.260

MT=107 : (N,A)
BASED ON THE CACULATION WITH PEGASUS. BELOW 10 MEV, EXPERIMENTAL DATA BY QAIM ET AL./16/ WERE ADOPTED.

MT=251 : MU-BAR
CALCULATED WITH OPTICAL MODEL.

MF=4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=2 : CALCULATED WITH OPTICAL MODEL.
MT=16,22,28,91: APPROXIMATELY TRANSFORMED FROM THE MF=6 DATA (DDX) OF JENDL FUSION FILE.
MT=51-71 : 90 DEGREE SYMMETRIC IN THE CENTER-OF-MASS SYSTEM, CALCULATED WITH CASTHY.

MF=5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=16,22,28,91: APPROXIMATELY TRANSFORMED FROM THE MF=6 DATA (DDX) OF JENDL FUSION FILE.

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15) BEER H. AND SPENCER R.R.: NUCL. PHYS., A240, 29 (1975).
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MAT number = 2843
 28-NI- 64 NAIG        EVAL-MAR87 S.IIJIMA
                       DIST-SEP89 REV2-SEP93
HISTORY
87-03  EVALUATION WAS PERFORMED FOR JENDL-3. SHORT DESCRIPTION
       ON THE EVALUATION IS GIVEN IN REF./1/
87-05  COMPILED BY K.SHIBATA (JAERI).
93-09  JENDL-3.2.
       COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (3,106), (3,111)     DELETED.
      (4,16-28), (4,91)    TAKEN FROM JENDL FUSION FILE
      (5,16-91)            TAKEN FROM JENDL FUSION FILE
     ***********************************************************

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      JENDL FUSION FILE /2/  (AS OF SEP. 1993)
        EVALUATED BY S.CHIBA (NDC/JAERI)
        COMPILED BY S.CHIBA

          CROSS SECTIONS WERE TAKEN FROM JENDL-3.1.  EDX'S OF
        MT=16, 22, 28 AND 91 WERE REPLACED BY THOSE CALCULATED
        WITH SINCROS-II CODE SYSTEM/3/ BECAUSE NORMALIZATION
        ERRORS WERE FOUND IN THE DATA STORED IN JENDL-3.1.  DDX'S
        OF CONTINUUM REACTIONS WERE CREATED WITH F15TOB PROGRAM
        /2/ IN WHICH KUMABE'S SYSTEMATICS /4/ WAS USED.  THE
        PRECOMPOUND/COMPOUND RATIO WAS CALCULATED BY THE SINCROS-
        II CODE SYSTEM.
          OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED
        IN THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./3/.
        LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/5/.
     -------------------------------------------------------------


MF=1,MT=451   COMMENTS AND DICTIONARY

MF=2,MT=151   RESOLVED RESONANCE PARAMETERS : 1.0E-5 EV - 553 KEV
        PARAMETERS WERE TAKEN FROM JENDL-2.
        SCATTERING RADIUS: 6.4 FM

       CALCULATED 2200 M/S VALUES AND RESONANCE INTEGRALS (BARN):
                           2200 M/S VALUE        RES.INT
           TOTAL             1.515                  -
           ELASTIC           0.035                  -
           CAPTURE           1.480                0.820

MF=3  NEUTRON CROSS SECTIONS
  BACKGROUND CROSS SECTIONS WERE APPLIED TO RESONANCE REGION.
  CROSS SECTIONS ABOVE 553 KEV WERE EVALUATED AS FOLLOWS :

     MT=1 : TOTAL CROSS SECTION
        EXPERIMENTAL DATA OF FARRELL ET AL./6/ WERE ADOPTED
        BETWEEN 553 KEV AND 698 KEV.  ABOVE 698 KEV UP TO 20 MEV,
        THE OPTICAL-MODEL CALCULATION WAS PERFORMED.  POTENTIAL
        PARAMETERS WERE OBTAINED BY FITTING NAT-NI DATA /7/:
          V =51.33 - 0.331*EN ,WS=8.068 + 0.112*EN ,VSO=7.0 (MEV)
          R0=RS0=1.24          ,RS=1.40                     (FM)
          A0=AS0=0.541         ,AS=0.4                      (FM)
        SURFACE IMAGINARY PART IS IN DERIVATIVE WOODS-SAXON FORM.

     MT=2 : ELASTIC SCATTERING
        (TOTAL) - (NONELASTIC CROSS SECTION).

     MT=3 : NONELASTIC CROSS SECTION
        SUM OF MT=4,16,17,22,28,102,103,104,105,107.

     MT=16,17,22,28,103,104,105: (N,2N),(N,3N),(N,N'A),(N,N'P),
                                 (N,P),(N,D),(N,T)
        CALCULATED WITH PEGASUS/8/.  INVERSE CROSS SECTIONS
        WERE CALCULATED FROM THE FOLLOWING OMP'S:
              PROTON   = PEREY/9/
              ALPHA    = HUIZENGA AND IGO/10/
              DEUTERON = LOHR AND HAEBERLI/11/
              HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/12/

     MT=4,51-70,91,102 : INELASTIC SCATTERING AND CAPTURE
        CALCULATED WITH THE STATISTICAL MODEL CODE CASTHY/13/.
        THE LEVEL SCHEME/14/ USED IS GIVEN AS FOLLOWS:
         NO  ENERGY(MEV) SPIN-PARITY
         G.S    0.0          0 +
          1.    1.3459       2 +
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```
           2.     2.2750       0 +
           3.     2.6080       4 +
           4.     2.7500       2 +
           5.     2.8650       0 +
           6.     2.8850       2 +
           7.     2.9710       2 +
           8.     3.0280       0 +
           9.     3.1650       4 +
          10.     3.2730       2 +
          11.     3.3930       3 +
          12.     3.4590       1 +
          13.     3.4830       4 +
          14.     3.5600       3 -
          15.     3.6470       2 +
          16.     3.7480       4 +
          17.     3.7950       1 +
          18.     3.8080       3 +
          19.     3.8480       5 -
          20.     3.9650       4 +
         CONTINUUM LEVELS ASSUMED ABOVE 4.084 MEV.  THE GAMMA-RAY
         STRENGTH FUNCTION OF 7.67E-6 WAS OBTAINED FROM THE CAPTURE
         CROSS SECTION DATA OF BEER AND SPENCER/15/.
         LEVEL DENSITY PARAMETERS ARE:
                                 PAIRING    SPIN-CUTOFF F.
              A(1/MEV) T(MEV) ENERGY(MEV)   (MEV**0.5)    EX(MEV)
     -------------------------------------------------------------
        NI-64   9.300   1.02    2.70         7.124         8.940
        NI-65  10.95    0.86    1.20         7.870         6.400
     -------------------------------------------------------------

      MT=107  : (N,A)
         CALCULATED WITH PEGASUS AND MODIFIED BELOW 11 MEV ON THE
         BASIS OF EXPERIMENTAL DATA OF QAIM ET AL./16/

      MT=251  : MU-BAR
         CALCULATED WITH OPTICAL MODEL.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2          : CALCULATED WITH OPTICAL MODEL.
  MT=16,22,28,91: APPROXIMATELY TRANSFORMED FROM THE MF=6 DATA
                  (DDX) OF JENDL FUSION FILE.
  MT=51-70      : 90 DEGREE SYMMETRIC IN THE CENTER-OF-MASS
                  SYSTEM, CALCULATED WITH CASTHY.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,22,28,91: APPROXIMATELY TRANSFORMED FROM THE MF=6 DATA
                  (DDX) OF JENDL FUSION FILE.
```

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```
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    AND TECHNOL., MITO, 1988, P.627 (1988).
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MAT number = 2900

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 29-CU-  0 NAIG,MAPI  EVAL-MAR87 N.YAMAMURO,T.KAWAKITA
                      DIST-SEP89 REV2-SEP93
HISTORY
87-03  EVALUATION WAS PERFORMED FOR JENDL-3.
87-05  COMPILED BY K.SHIBATA (JAERI).
93-09  JENDL-3.2.
         (3,1),(3,2),(3,102)        MODIFIED BY T.NAKAGAWA(JAERI)
         (12,102),(13,4),(15,102)  MODIFIED BY S.IGARASI(NEDAC)
       COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)              UPPER BOUNDARY ENERGY CHANGED TO 50 KEV
      (3,1),(3,2)          50 KEV - 200 KEV
      (3,102)              50 KEV - 20 MEV
      (4,16-32),(4,91)     TAKEN FROM JENDL FUSION FILE
      (5,16-91)            TAKEN FROM JENDL FUSION FILE
      (12,102),(13,4),(15,102)
     **********************************************************

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      JENDL FUSION FILE /1/  (AS OF SEP. 1993)
        EVALUATED BY B.YU(CIAE) AND S.CHIBA (NDC/JAERI)
        COMPILED BY B.YU

          CROSS SECTIONS WERE TAKEN FROM JENDL-3.1.  MF=6 (DDX'S)
        OF MT=16, 22, 28, 32 AND 91 WERE CREATED WITH F15TOB
        PROGRAM /1/.  MODIFIED KUMABE'S SYSTEMATICS /1/ WAS
        USED.  THE PRECOMPOUND/COMPOUND RATIO WAS CALCULATED BY
        THE SINCROS-II CODE SYSTEM/2/.
          OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED
        IN THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./2/.
        LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/3/.
     -------------------------------------------------------------


MF=1          GENERAL INFORMATION
  MT=451    DESCRIPTIVE DATA AND DICTIONARY

MF=2          RESONANCE PARAMETERS
  MT=151    RESOLVED RESONANCE PARAMETERS FOR MLBW FORMULA
     CONSTRUCTED FROM PARAMETERS FOR EACH ISOTOPE WHICH WERE
     MAINLY TAKEN FROM THE WORK OF MUGHABGHAB ET AL. /4/
       RESONANCE REGION : 1.0E-5 EV TO 50 KEV.
         UPPER BOUNDARY OF THE RESONANCE REGION WAS CHANGED FROM
         153 KEV OF JENDL-3.1 TO 50 KEV BECAUSE SERIOUS LEVEL
         MISSING WAS FOUND ABOVE 50 KEV.
       SCATTERING RADIUS: 6.70 FM FOR CU-63 AND CU-65

     CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS
                 2200-M/S         RES. INTEG.
      ELASTIC     7.868 B            -
      CAPTURE     3.785 B          4.153 B
      TOTAL      11.653 B            -

MF=3          NEUTRON CROSS SECTIONS
     CONSTRUCTED FROM ISOTOPE DATA.

  MT=1  TOTAL
        BELOW  50 KEV : NO BACKGROUND CROSS SECTIONS ARE GIVEN.
        50 TO 200 KEV : BASED ON THE MEASURED DATA OF GARG ET
                        AL./5/ BELOW 100 KEV AND OF WHALEN ET
                        AL./6/ BETWEEN 100 AND 200 KEV.  THE
                        DATA WERE SMOOTHED WITH 5% RESOLUTION.
        0.200 TO 3 MEV: BASED ON THE EXPERIMENTAL DATA OF
                        NATURAL ELEMENT /7,8/
        3 TO 20 MEV   : OPTICAL-MODEL CALCULATION USING CASTHY
                        /9/

     THE OPTICAL POTENTIAL PARAMETERS USED ARE AS FOLLOWS /10/ (IN
     THE UNITS OF MEV AND FM):
          V  = 51.725 - 0.447*E    R0 = 1.221    A0  = 0.683
          WS = 8.44 + 0.055*E      RS = 1.223    AS  = 0.507
          VSO= 8.0                 RSO= 1.221    ASO = 0.683

  MT=2  ELASTIC SCATTERING
        (TOTAL) - (REACTION CROSS SECTION)

  MT=4,51-87,91 INELASTIC SCATTERING
        STATISTICAL MODEL CALCULATIONS WERE MADE WITH CASTHY/9/
        BELOW 3 MEV BY TAKING ACCOUNT OF COMPETING PROCESSES,
        AND WITH GNASH/11/ ABOVE 3 MEV INCLUDING PREEQUILIBRIUM
```

EFFCETS. THE DIRECT PROCESS COMPONENTS WERE CONSIDERED FOR 10 DISCRETE LEVELS.

CU-63 NO.	ENERGY(MEV)		CU-65 NO.	ENERGY(MEV)	
G.S.	0.0	3/2 -	G.S.	0.0	3/2 -
1.	0.6697	1/2 -	1.	0.7706	1/2 -
2.	0.9621	5/2 -	2.	1.1160	5/2 -
3.	1.3270	7/2 -	3.	1.4820	7/2 -
4.	1.4120	5/2 -	4.	1.6230	5/2 -
5.	1.5470	3/2 -	5.	1.7250	3/2 -
6.	1.8610	7/2 -	6.	2.0940	7/2 -
7.	2.0110	3/2 -	7.	2.1070	5/2 -
8.	2.0620	1/2 -	8.	2.2130	1/2 -
9.	2.0810	5/2 -	9.	2.2780	7/2 -
10.	2.0930	7/2 -	10.	2.3290	3/2 -
11.	2.2080	9/2 -	11.	2.4070	9/2 -
12.	2.3370	5/2 -	12.	2.5260	9/2 +
13.	2.4050	7/2 -	13.	2.5330	5/2 -
14.	2.4970	3/2 -	14.	2.5340	7/2 +
15.	2.5050	9/2 +	15.	2.5930	1/2 -
16.	2.5120	1/2 -	16.	2.6440	9/2 -
17.	2.5360	5/2 -	17.	2.6500	5/2 -
			18.	2.6550	5/2 -
			19.	2.6690	5/2 -
			20.	2.7530	9/2 +

LEVELS ABOVE 2.54 MEV AND 2.80 MEV WERE ASSUMED TO BE OVERLAPPING FOR CU-63 AND CU-65, RESPECTIVELY.

MT=16,22,28,32,103,104 (N,2N),(N,N'A),(N,N'P),(N,N'D),(N,P) (N,D) CROSS SECTIONS
CALCULATED WITH GNASH/11/. OPTICAL POTENTIAL PARAMETERS FOR PROTON, ALPHA-PARTICLE AND DEUTERON WERE AS FOLLOWS /12,13,14/.

PROTON

```
V  = 59.11 - 0.55*E     R0 = 1.25    A0 = 0.65
WS = 10.4               RS = 1.25    AS = 0.47
VSO= 7.5                RSO= 1.25    ASO= 0.47
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ALPHA-PARTICLE

```
V  = 164.7              R0 = 1.442   A0 = 0.52
WV = 22.4               RV = 1.442   AV = 0.52
                        RC = 1.30
```

DEUTERON

```
V  = 106.69             R0 = 1.05    A0 = 0.86
WS = 13.92              RS = 1.43    AS = 0.704
VSO= 7.0                RSO= 0.75    ASO= 0.5
                        RC = 1.3
```

MT=107 (N,A) CROSS SECTION
CALCULATED CROSS SECTIONS OF CU-63 WERE NORMALIZED TO THE EXPERIMENTAL DATA /15/ AT 10 MEV. ABOVE 12 MEV, THE EXCITATION FUNCTION FOLLOWS THE DATA OF PAULSEN/16/. FOR CU-65, THE GNASH CALCULATION WAS EMPLOYED.

MT=102 RADIATIVE CAPTURE CROSS SECTION
THE CU-63 (N,GAMMA) CROSS SECTION WAS ADOPTED FROM JENDL ACTIVATION FILE CALCULATED WITH SINCROS-II/17/. THE CROSS SECTION OF CU-65 WAS BASED ON CASTHY CALCULATION AND EXPERIMENTAL DATA/18,19,20/. THE CAPTURE CROSS SECTION FOR NATURAL CU WAS CONSTRUCTED FROM THE ISOTOPE DATA.

Q-VALUE OF 7.7661 MEV WAS GIVEN BY AVERAGING ISOTOPE Q-VALUES.

MT=251 MU-BAR
CALCULATED WITH OPTICAL MODEL.

MF=4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=2,51-87
CALCULATED WITH CASTHY FOR EQUILIBRIUM PROCESS. THE COMPONENTS OF THE DIRECT PROCESS WERE ADDED TO 10 LEVELS BY USING THE DWUCK CODE /21/.
MT=16, 22, 28, 32, 91
TAKEN FROM JENDL FUSION FILE.

MF=5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=16, 22, 28, 32, 91
TAKEN FROM JENDL FUSION FILE.

```
MF=12         PHOTON PRODUCTION MULTIPLICITIES
  MT=102
        DETERMINED FROM ENERGY BALANCE.

MF=13         PHOTON PRODUCTION CROSS SECTIONS
  MT=3 (ABOVE 2.5 MEV)
        CALCULATED WITH GNASH.
  MT=4 (BELOW 2.5 MEV)
        COMPOSITE DATA FROM LEVEL EXCITATION CROSS SECTIONS AND
        BRANCHING RATIOS OF 2 ISOTOPES BELOW 2.5 MEV.
  MT=103, 107 (BELOW 2.5 MEV)
        COMPOSED FROM 2 ISOTOPE DATA CALCULATED WITH GNASH.

MF=14         PHOTON ANGULAR DISTRIBUTIONS
  MT=3,4,102,103,107
        ASSUMED TO BE ISOTROPIC.

MF=15         PHOTON ENERGY DISTRIBUTIONS
  MT=3 (ABOVE 2.5 MEV)
        CALCULATED WITH GNASH.
  MT=102 (BELOE 2.5 KEV)
        SPECTRA CALCULATED WITH CASTHY FOR 2 ISOTOPES, TAKING
        PRIMARY TRANSITIONS AT 1.0E-5, 2.53E-2, 1.0E+2, 1.0E+4,
        1.0E+5, 2.0E+5, 5.0E+5, 1.0E+6, 2.0E+6 AND 2.5E+6 EV.
  MT=103, 107 (BELOW 2.5 MEV)
        COMPOSED FROM 2 ISOTOPE DATA CALCULATED WITH GNASH.
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MAT number = 2925

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 29-CU- 63 NAIG,MAPI  EVAL-MAR87 N.YAMAMURO,T.KAWAKITA
                      DIST-SEP89 REV2-SEP93
HISTORY
87-03  EVALUATION WAS PERFORMED FOR JENDL-3.
87-05  COMPILED BY K.SHIBATA.
93-09  JENDL-3.2.
         (3,1),(3,2),(3,102)  MODIFIED BY T.NAKAGAWA(JAERI)
         (12,102),(15,102)    MODIFIED BY S.IGARASI(NEDAC)
       COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)              UPPER BOUNDARY ENERGY CHANGED TO 50 KEV
      (3,1),(3,2)          50 KEV - 153 KEV
      (3,102)              50 KEV - 20 MEV
      (4,16-32),(4,91)     TAKEN FROM JENDL FUSION FILE
      (5,16-91)            TAKEN FROM JENDL FUSION FILE
      (12,102),(15,102)
     ***********************************************************

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      JENDL FUSION FILE /1/  (AS OF SEP. 1993)
        EVALUATED BY B.YU(CIAE) AND S.CHIBA (NDC/JAERI)
        COMPILED BY B.YU

          CROSS SECTIONS WERE TAKEN FROM JENDL-3.1.  MF=6 (DDX'S)
        OF MT=16, 22, 28, 32 AND 91 WERE CREATED WITH F15TOB
        PROGRAM /1/.  MODIFIED KUMABE'S SYSTEMATICS /1/ WAS USED.
        THE PRECOMPOUND/COMPOUND RATIO WAS CALCULATED BY THE
        SINCROS-II CODE SYSTEM/2/.
          OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED
        IN THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./2/.
        LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/3/.
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MF=1          GENERAL INFORMATION
  MT=451    DESCRIPTIVE DATA AND DICTIONARY

MF=2          RESONANCE PARAMETERS
  MT=151    RESOLVED RESONANCE PARAMETERS FOR MLBW FORMULA
     PARAMETERS WERE MAINLY TAKEN FROM THE WORK OF MUGHABGHAB
     ET AL./4/
     RESONANCE REGION : 1.0E-5 EV TO 50 KEV.
         UPPER BOUNDARY OF THE RESONANCE REGION WAS CHANGED FROM
         153 KEV OF JENDL-3.1 TO 50 KEV BECAUSE SERIOUS LEVEL
         MISSING WAS FOUND ABOVE 50 KEV.
     SCATTERING RADIUS: 6.70 FM
     CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS
                  2200-M/S         RES. INTEG.
      ELASTIC     5.102 B             -
      CAPTURE     4.506 B           5.01 B
      TOTAL       9.608 B             -

MF=3          NEUTRON CROSS SECTIONS

  MT=1      TOTAL
        50 TO 153 KEV : BASED ON THE MEASURED DATA OF ROHR ET
                        AL./5/  THE DATA WERE SMOOTHED WITH 5%
                        RESOLUTION.
        0.153 TO 3 MEV: BASED ON THE EXPERIMENTAL DATA OF NATURAL
                        ELEMENT /6,7/
        3 TO 20 MEV   : OPTICAL-MODEL CALCULATION WITH CASTHY/8/
             THE OPTICAL POTENTIAL PARAMETERS USED ARE AS
             FOLLOWS /9/ (IN THE UNITS OF MEV AND FM):
          V  = 51.725 - 0.447*E   R0 = 1.221    A0  = 0.683
          WS = 8.44 + 0.055*E     RS = 1.223    AS  = 0.507
                                (DERIVATIVE WOODS-SAXON FORM)
          VSO= 8.0                RSO= 1.221    ASO = 0.683

  MT=2      ELASTIC SCATTERING
        (TOTAL) - (REACTION CROSS SECTIONS)

  MT=4,51-67,91 INELASTIC SCATTERING
        STATISTICAL MODEL CALCULATIONS WERE MADE WITH CASTHY/8/
        BELOW 3 MEV BY TAKING ACCOUNT OF COMPETING PROCESSES, AND
        WITH GNASH/10/ ABOVE 3 MEV INCLUDING PREEQUILIBRIUM
        EFFECTS.  THE DIRECT-PROCESS COMPONENTS WERE CONSIDERED
        FOR THE LEVELS OF MT=51-54,65,91 BY THE DWBA CALCULATIONS
        WITH DWUCK/11/.  THE LEVEL SCHEME WAS TAKEN FROM REF./12/.
          NO.    ENERGY(MEV) SPIN-PARITY
          G.S.      0.0        3/2 -
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           1.        0.6697      1/2 -
           2.        0.9621      5/2 -
           3.        1.3270      7/2 -
           4.        1.4120      5/2 -
           5.        1.5470      3/2 -
           6.        1.8610      7/2 -
           7.        2.0110      3/2 -
           8.        2.0620      1/2 -
           9.        2.0810      5/2 -
          10.        2.0930      7/2 -
          11.        2.2080      9/2 -
          12.        2.3370      5/2 -
          13.        2.4050      7/2 -
          14.        2.4970      3/2 -
          15.        2.5050      9/2 +
          16.        2.5120      1/2 -
          17.        2.5360      5/2 -
        LEVELS ABOVE 2.54 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT=16,22,28,32,103,104 (N,2N),(N,N'A),(N,N'P),(N,N'D),(N,P)
     (N,D) CROSS SECTIONS
        CALCULATED WITH GNASH/10/.
        OPTICAL POTENTIAL PARAMETERS FOR PROTON, ALPHA-PARTICLE
        AND DEUTERON WERE AS FOLLOWS /13,14,15/.
     PROTON
        V  = 59.11 - 0.55*E    R0 = 1.25    A0 = 0.65
        WS = 10.4              RS = 1.25    AS = 0.47
        VSO= 7.5               RSO= 1.25    ASO= 0.47
     ALPHA-PARTICLE
        V  = 164.7             R0 = 1.442   A0 = 0.52
        WV = 22.4              RV = 1.442   AV = 0.52
                               RC = 1.30
     DEUTERON
        V  = 106.69            R0 = 1.05    A0 = 0.86
        WS = 13.92             RS = 1.43    AS = 0.704
        VSO= 7.0               RSO= 0.75    ASO= 0.5
                               RC = 1.3

  MT=102    RADIATIVE CAPTURE CROSS SECTION
        TAKEN FROM JENDL ACTIVATION CROSS SECTION FILE.  THE CROSS
        SECTION WAS CALCULATED BY N.YAMAMURO/16/ WITH SINCROS-II.

  MT=107    (N,A) CROSS SECTION
        CALCULATED CROSS SECTIONS WERE NORMALIZED TO THE
        EXPERIMENTAL DATA/17/ AT 10 MEV.  ABOVE 12 MEV, THE
        EXCITATION FUNCTION FOLLOWS THE DATA OF PAULSEN/18/.

  MT=251    MU-BAR
        CALCULATED WITH CASTHY

MF=4        ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,51-67
        CALCULATED WITH CASTHY FOR EQUILIBRIUM PROCESS.  THE
        COMPONENTS OF THE DIRECT PROCESS WERE ADDED TO THE LEVELS
        OF MT=51-54,65 BY USING THE DWUCK CODE /13/.
  MT=16, 22, 28, 32, 91
        TAKEN FROM JENDL FUSION FILE.

MF=5        ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16, 22, 28, 32, 91
        TAKEN FROM JENDL FUSION FILE.

MF=12       PHOTON PRODUCTION MULTIPLICITIES
  MT=16,22,28,32,91,103,104,107
        CALCULATED WITH GNASH.
  MT=51-67
        TRANSITION PROBABILITIES ARE GIVEN.
  MT=102
        OBTAINED FROM ENERGY BALANCE.

MF=14       PHOTON ANGULAR DISTRIBUTIONS
  MT=16,22,28,32,51-67,91,102,103,104,107
        ASSUMED TO BE ISOTROPIC.

MF=15       PHOTON ENERGY DISTRIBUTIONS
  MT=16,22,28,32,91,103,104,107
        CALCULATED WITH GNASH.
  MT=102
        CALCULATED WITH CASTHY.

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```

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MAT number = 2931
 29-CU- 65 NAIG,MAPI  EVAL-MAR87 N.YAMAMURO,T.KAWAKITA
                      DIST-SEP89 REV2-SEP93
HISTORY
87-03  EVALUATION WAS PERFORMED FOR JENDL-3.
87-05  COMPILED BY K.SHIBATA (JAERI).
93-09  JENDL-3.2.
         (3,1),(3,2),(3,102)  MODIFIED BY T.NAKAGAWA(JAERI)
         (12,102),(15,102)    MODIFIED BY S.IGARASI(NEDAC)
       COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)             UPPER BOUNDARY ENERGY CHANGED TO 50 KEV
      (3,1),(3,2)         50 KEV - 153 KEV
      (3,102)             50 KEV - 20 MEV
      (4,16-32),(4,91)    TAKEN FROM JENDL FUSION FILE
      (5,16-91)           TAKEN FROM JENDL FUSION FILE
      (12,102),(15,102)
     ***********************************************************

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      JENDL FUSION FILE /1/  (AS OF SEP. 1993)
        EVALUATED BY B.YU(CIAE) AND S.CHIBA (NDC/JAERI)
        COMPILED BY B.YU

          CROSS SECTIONS WERE TAKEN FROM JENDL-3.1.  MF=6 (DDX'S)
        OF MT=16, 22, 28, 32 AND 91 WERE CREATED WITH F15TOB
        PROGRAM /1/.  MODIFIED KUMABE'S SYSTEMATICS /1/ WAS USED.
        THE PRECOMPOUND/COMPOUND RATIO WAS CALCULATED BY THE
        SINCROS-II CODE SYSTEM/2/.
          OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED
        IN THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./2/.
        LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/3/.
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MF=1          GENERAL INFORMATION
  MT=451    DESCRIPTIVE DATA AND DICTIONARY

MF=2          RESONANCE PARAMETERS
  MT=151    RESOLVED RESONANCE PARAMETERS FOR MLBW FORMULA
     PARAMETERS WERE MAINLY TAKEN FROM THE WORK OF MUGHABGHAB
     ET AL./4/
     RESONANCE REGION : 1.0E-5 EV TO 50 KEV.
         UPPER BOUNDARY OF THE RESONANCE REGION WAS CHANGED FROM
         153 KEV OF JENDL-3.1 TO 50 KEV BECAUSE SERIOUS LEVEL
         MISSING WAS FOUND ABOVE 50 KEV.
     SCATTERING RADIUS: 6.70 FM
     CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS
                 2200-M/S         RES. INTEG.
      ELASTIC     14.073 B            -
      CAPTURE      2.168 B          2.22  B
      TOTAL       16.242 B            -

MF=3          NEUTRON CROSS SECTIONS
  MT=1      TOTAL
        50 TO 250 KEV : BASED ON THE MEASURED DATA OF ROHR ET
                        AL./5/  THE DATA WERE SMOOTHED WITH 5%
                        RESOLUTION.
        0.3 TO 3 MEV  : BASED ON THE EXPERIMENTAL DATA OF NATURAL
                        ELEMENT/6,7/.
        3 TO 20 MEV   : OPTICAL-MODEL CALCULATION WITH CASTHY/8/.
              THE OPTICAL POTENTIAL PARAMETERS USED ARE AS
              FOLLOWS/9/ (IN THE UNITS OF MEV AND FM):
          V  = 51.725 - 0.447*E   R0 = 1.221    A0  = 0.683
          WS = 8.44 + 0.055*E     RS = 1.223    AS  = 0.507
                                (DERIVATIVE WOODS-SAXON FORM)
          VSO= 8.0                RSO= 1.221    ASO = 0.683

  MT=2      ELASTIC SCATTERING
        (TOTAL) - (REACTION CROSS SECTION)

  MT=4,51-70,91 INELASTIC SCATTERING
        STATISTICAL MODEL CALCULATIONS WERE MADE WITH CASTHY/8/
        BELOW 3 MEV BY TAKING ACCOUNT OF COMPETING PROCESSES, AND
        WITH GNASH/10/ ABOVE 3 MEV INCLUDING PREEQUILIBRIUM
        EFFECTS.  THE DIRECT-PROCESS COMPONENT WAS CONSIDERED FOR
        THE LEVELS OF MT=51-54,64,91 BY THE DWBA CALCULATIONS WITH
        DWUCK/11/.  THE LEVEL SCHEME WAS TAKEN FROM REF./12/.
          NO.    ENERGY(MEV) SPIN-PARITY
          G.S.    0.0         3/2 -
           1.     0.7706      1/2 -
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           2.      1.1160      5/2 -
           3.      1.4820      7/2 -
           4.      1.6230      5/2 -
           5.      1.7250      3/2 -
           6.      2.0940      7/2 -
           7.      2.1070      5/2 -
           8.      2.2130      1/2 -
           9.      2.2780      7/2 -
          10.      2.3290      3/2 -
          11.      2.4070      9/2 -
          12.      2.5260      9/2 +
          13.      2.5330      5/2 -
          14.      2.5340      7/2 +
          15.      2.5930      1/2 -
          16.      2.6440      9/2 -
          17.      2.6500      5/2 -
          18.      2.6550      5/2 -
          19.      2.6690      5/2 -
          20.      2.7530      9/2 +

        LEVELS ABOVE 2.80 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT=16,22,28,32,103,104,107 (N,2N),(N,N'A),(N,N'P),(N,N'D),(N,P)
     (N,D) AND (N,A) CROSS SECTIONS
        CALCULATED WITH GNASH/10/.
        OPTICAL POTENTIAL PARAMETERS FOR PROTON, ALPHA-PARTICLES
        AND DEUTERON WERE AS FOLLOWS/13,14,15/.
     PROTON
        V  = 59.11 - 0.55*E    R0 = 1.25    A0 = 0.65
        WS = 10.4              RS = 1.25    AS = 0.47
        VSO= 7.5               RSO= 1.25    ASO= 0.47
     ALPHA-PARTICLE
        V  = 164.7             R0 = 1.442   A0 = 0.52
        WV = 22.4              RV = 1.442   AV = 0.52
                               RC = 1.30
     DEUTERON
        V  = 106.69            R0 = 1.05    A0 = 0.86
        WS = 13.92             RS = 1.43    AS = 0.704
        VSO= 7.0               RSO= 0.75    ASO= 0.5
                               RC = 1.3

  MT=102    RADIATIVE CAPTURE CROSS SECTION
        BELOW 1.505 MEV, CALCULATION WITH CASTHY WAS ADOPTED.  A
        VALUE OF 0.001 WAS EMPLOYED FOR THE GAMMA-RAY STRENGTH
        FUNCTION FOR S-WAVE NEUTRONS.  ABOVE THIS ENERGY, CROSS
        SECTION CURVE WAS BASED ON THE EXPERIMENTAL DATA/16, 17,
        18/.  0.5MB WAS ASSUMED AT 14 MEV.

  MT=251    MU-BAR
        CALCULATED WITH CASTHY.

MF=4          ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,51-70
        CALCULATED WITH CASTHY FOR EQUILIBRIUM PROCESS.  THE
        COMPONENTS OF THE DIRECT PROCESS WERE ADDED TO THE LEVELS
        OF MT=51-54,64 BY USING THE DWUCK CODE /11/.
  MT=16, 22, 28, 32, 91
        TAKEN FROM JENDL FUSION FILE.

MF=5          ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16, 22, 28, 32, 91
        TAKEN FROM JENDL FUSION FILE.

MF=12         PHOTON PRODUCTION MULTIPLICITIES
  MT=16,22,28,32,91,103,104,107
        CALCULATED WITH GNASH.
  MT=51-70
        TRANSITION PROBABILITIES ARE GIVEN.
  MT=102
        OBTAINED FROM ENERGY BALANCE.

MF=14         PHOTON ANGULAR DISTRIBUTIONS
  MT=16,22,28,32,51-70,91,102,103,104,107
        ASSUMED TO BE ISOTROPIC.

MF=15         PHOTON ENERGY DISTRIBUTIONS
  MT=16,22,28,32,91,103,104,107
        CALCULATED WITH GNASH.
  MT=102
        CALCULATED WITH CASTHY.

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```

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MAT number = 3100

```
 31-GA- 0  KHI        EVAL-MAR94 T.WATANABE
                      DIST-APR94
HISTORY
94-3  NEW EVALUATION WAS CONSTRUCTED FROM ISOTOPES DATA

MF=1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF=2  RESONANCE PARAMETERS
  MT=151 RESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE PARAMETERS FOR MLBW FORMULA (BELOW 5.9KEV.)
    THE DATA WERE CONSTRUCTED FROM THE EVALUATED RESONANCE
    PARAMETERS FOR GA-69 AND GA-71, CONSIDERING THEIR
    ABUNDANCES/1/.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S                RES. INTEG.
      TOTAL          9.8                       -
      ELASTIC        7.0                       -
      CAPTURE        2.8                     23.8

MF=3  NEUTRON CROSS SECTIONS
  BELOW 5.9 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 5.6 KEV, THE TOTAL, ELASTIC AND INELASTIC SCATTERING, AND
  CAPTURE PARTIAL CROSS SECTION WERE GIVEN USING EACH ISOTOPES
  DATA CALCULATED WITH CASTHY PROGRAM/2/.

  MT=16,22,28,32,102,103,104,105,106,107,111,251
     (N,2N),(N,NA),(N,NP),(N,ND),(N,P),(N,D),(N,T),(N,HE-3),
     (N,A),(N,2P),MU-BAR
  WERE CONSTRUCTED FROM EACH GA ISOTOPE DATA CONSIDERING
  ABUNDANCES.
  CROSS SECTIONS FOR EACH ISOTOPE WERE EVALUATED USING CASTHY
  AND MADIFIED EGNASH-2/3/ PROGRAMM.

  NEUTRON OPTICAL POTENTIAL PARAMETERS USED WERE AS FOLLOWS.

               DEPTH (MEV)        R*A**(1/3)    DIFFUSENESS(FM)
         ----------------------   -----------   ---------------
     V  = 49.42-0.5867E         , R0 =  1.293     , A0 =  0.415
     WS = 5.381+0.4117E         , RS =  1.308     , AS =  0.456
     WSO= 8.552                 , RSO=  1.583     , ASO=  0.648

  THE LEVEL SCHEME WAS ADOPTED FROM ENSDF FILE.
           NO.      ENERGY(MEV)    SPIN-PARITY      ISOTOPE
           GR.       0.0000         3/2 -           GA-69,-71
            1        0.3187         1/2 -           GA-69
            2        0.3900         1/2 -           GA-71
            3        0.4872         5/2 -           GA-71
            4        0.5116         3/2 -           GA-71
            5        0.5741         5/2 -           GA-69
            6        0.7140        11/2 -           GA-71
            7        0.8720         3/2 -           GA-69
            8        0.9103         3/2 -           GA-71
            9        0.9648         5/2 -           GA-71
           10        1.0285         1/2 -           GA-69
           11        1.1068         5/2 -           GA-69
                     1.1074         7/2 -           GA-71
                     1.1093         1/2 -           GA-71
           12        1.1340         7/2 -           GA-69
           13        1.3366         7/2 -           GA-69
           14        1.3952         7/2 -           GA-71
           15        1.4759         5/2 -           GA-71
           16        1.4880         7/2 -           GA-69
                     1.4937         9/2 +           GA-71
                     1.4986         5/2 -           GA-71
           17        1.5259         3/2 -           GA-69
           18        1.6316         3/2 -           GA-71
           19        1.7022         1/2 +           GA-71
           20        1.7198         5/2 -           GA-71
           21        1.7237         5/2 -           GA-69
           22        1.7524         3/2 -           GA-71
                     1.7648         9/2 -           GA-69
           23        1.8916         3/2 -           GA-69
                     1.9040         5/2 -           GA-71
           24        1.9242         7/2 -           GA-69
           25        1.9410         3/2 +           GA-71
           26        1.9724         9/2 +           GA-69
                     1.9731         1/2 -           GA-69
           27        2.0076         3/2 -           GA-69
                     1.9950         5/2 -           GA-71
```

28	2.0238	5/2 -	GA-69
29	2.0452	5/2 -	GA-69
30	2.0640	1/2 -	GA-71
31	2.1342	5/2 -	GA-71
32	2.1980	13/2 -	GA-69
	2.1913	5/2 -	GA-71
	2.2060	5/2 -	GA-71
33	2.2193	1/2 +	GA-69
34	2.2510	1/2 -	GA-69
	2.2472	7/2 +	GA-71
35	2.2944	1/2 -	GA-71
36	2.3195	7/2 +	GA-69
	2.3273	1/2 -	GA-71
37	2.3533	5/2 -	GA-69
38	2.4233	13/2 -	GA-69
	2.4288	5/2 -	GA-69

LEVELS ABOVE 2.33 MEV WERE ASSUMED TO BE OVERLAPPING.

PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GIRBERT-CAMERON WERE EVALUATED.
SPIN CUT-OFF PARAMETER C1 WAS TAKEN AS 0.146.

	GA- 69	GA- 70	GA- 71	GA-72
A (MEV)	11.340	11.590	13.000	12.900
SPIN CUT-OFF PARAM.	8.271	8.442	9.026	9.075
PAIRING ENERGY (MEV)	1.500	0.0	1.430	0.0
NORMALIZATION FACTOR	1481.60	1536.20	1747.70	1758.60
E-JOINT (MEV)	6.924	4.221	6.326	4.961

MF=4 MT=2,16,22,28,32,51-88,91
(N,2N),(N,NA),(N,NP),(N,ND) AND ELASTIC AND INELASTIC SCATTERING ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CONSTRUCTED FROM EACH GA ISOTOPE DATA CONSIDERING ABUNDANCES.

MF=5 MT=16,22,28,32,91
(N,2N),(N,NA),(N,NP),(N,ND) AND CONTINUM INELASTIC SCATTERING ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CONSTRUCTED FROM EACH GA ISOTOPE DATA CONSIDERING ABUNDANCES.

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MAT number = 3125

```
 31-GA- 69 KHI          EVAL-MAR94 T.WATANABE
                        DIST-APR94
HISTORY
94-3  NEWLY EVALUATED.

MF=1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF=2  RESONANCE PARAMETERS
  MT=151 RESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE PARAMETERS FOR MLBW FORMULA (BELOW 5.9KEV.)
  NEGATIVE ENERGY LEVEL PARAMETERS WERE ADJUSTED TO REPRODUCE
  KOESTER'S DATA/1/. EVALUATION WERE MAINLY BASED ON OHKUBO'S
  DATA/2/ AND MUGHABGHAB'S COMPILATION/3/.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                   2200 M/S               RES. INTEG.
      TOTAL       10.36                      -
      ELASTIC      8.16                      -
      CAPTURE      2.20                    18.23

MF=3  NEUTRON CROSS SECTIONS
  BELOW 5.9 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 5.9 KEV, THE TOTAL, ELASTIC AND INELASTIC SCATTERING, AND
  CAPTURE CROSS SECTIONS WERE CALCULATED WITH THE OPTICAL AND
  STATISTICAL MODEL CODE CASTHY/4/.
  OPTICAL MODEL PARAMETERS USED IN CASTHY CALCULATION WERE AS
  FOLLOWS.

               DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
         ----------------------  ------------  ---------------
     V  = 49.42-0.5867E         , R0 =  5.3033     , A0 =  0.415
     WS = 5.381+0.4117E         , RS =  5.3648     , AS =  0.456
     WSO= 8.552                 , RSO=  6.4928     , ASO=  0.648


  THE LEVEL SCHEME WAS ADOPTED FROM ENSDF FILE/5/.
           NO.      ENERGY(MEV)    SPIN-PARITY  BETA2/BETA3
           GR.       0.0000          3/2 -
            1        0.3187          1/2 -        0.2
            2        0.5741          5/2 -        0.2
            3        0.8720          3/2 -        0.2
            4        1.0285          1/2 -        0.2
            5        1.1068          5/2 -        0.15
            6        1.1340          7/2 -        0.15
            7        1.3366          7/2 -        0.15
            8        1.4880          7/2 -        0.15
            9        1.5259          3/2 -        0.15
           10        1.7237          5/2 -        0.15
           11        1.7648          9/2 -
           12        1.8916          3/2 -
           13        1.9242          7/2 -
           14        1.9724          9/2 +
           15        1.9731          1/2 -
           16        2.0076          3/2 -
           17        2.0238          5/2 -
           18        2.0452          5/2 -
           19        2.1980         13/2 -
           20        2.2193          1/2 +
           21        2.2510          1/2 -
           22        2.3195          7/2 +
           23        2.3533          5/2 -
           24        2.4233         13/2 -
           25        2.4287          5/2 -
      LEVELS ABOVE 2.43 MEV WERE ASSUMED TO BE OVERLAPPING.

  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GIRBERT-
  CAMERON WERE EVALUATED.
  SPIN CUT-OFF PARAMETER C1 WAS TAKEN AS 0.146.

                                 GA- 69      GA- 70
                                --------    --------
          A (MEV)                11.340      11.590
          SPIN CUT-OFF PARAM.     8.271       8.442
          PAIRING ENERGY (MEV)    1.500       0.0
          NORMALIZATION FACTOR  1481.60     1536.20
          E-JOINT (MEV)           6.924       4.221

  THE CAPTURE CROSS SECTION WAS NORMALIZED TO 60 MILLIBARNS AT
  100KEV TO REPRODUCE DOVBENKO'S DATA/6/.
  ABOVE 1 MEV, DIRECT/SEMIDIRECT CAPTURE CROSS SECTION NORMALIZED
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  TO 0.77MB AT 14 MEV WERE ADED TO CASTHY'S RESULTS/7/.

  MT=16,22,28,32,33,103,104,105,106,107,111
     (N,2N),(N,NA),(N,NP),(N,ND),(N,NT),(N,P).(N,D),(N,T),
     (N,HE-3),(N,A),(N,2P)
  WERE EVALUATED WITH MODIFIED EGNASH-2/8/ USING F2=0.6 AND
  FOLLOWING OPTICAL POTENTIAL
     NEUTRON    :SAME AS USED IN CASTHY
     PROTON     :PEREYS OMP/9/
     DEUTRON    :LOHR-HAEBERLIS OMP/10/
     TRITON     :BECCHETTI-GREENLESS OMP/11/
     HE-3       :BECCHETTI-GREENLESS OMP
     ALPHA      :LEMOS OMP/12/
  AND NORMALIZED TO FOLLOWING DATA.
     (N,2N)     886.0    MB     CHATTERJEE'S DATA/13/
     (N,NA)       2.2    MB     SYSTEMATICS/14/
     (N,NP)      17.3    MB     SYSTEMATICS
     (N,P)       38.0    MB     QAIMS DATA/15,16/
     (N,D)        6.87   MB     SYSTEMATICS
     (N,T)        0.55   MB     SYSTEMATICS
     (N,A)       22.0    MB     AV. EXP. DATA/17/

  THE MU-BAR(MT=251) WAS ALSO CALCULATED WITH CASTHY.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,16,22,28,32,51-75,91
  ELASTIC AND INELASTIC SCATTERING CROSS SECTION,(N,2N),(N,NA),
  (N,NP) AND (N,ND)
  ANGULAR DISTRIBUTIONS WERE CALCULATED WITH CASTHY FOR ELA-
  STICALLY AND INELASTICALLY SCATTERED NEUTRONS.
  DIECT INELASTIC CONTRIBUTIONS WERE EVALUATED WITH DWUCKY/18/,
  AND ADDED TO CASTHY'S RESULTS.
  DEFORMATION PARAMETERS USED IN THE DWUCKY CALCULATION WERE
  EVALUATED FROM COMPILATION/19,20/ AND ENSDF HALF LIFE DATA.
  AS FOR (N,2N),(N,NA),(N,NP) AND (N,ND),ISOTROPIC DISTRIBUTION
  WAS ASSUMED.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,22,28,32,91
  FOR (N,2N),(N,NA),(N,NP),(N,ND) AND CONTINUM INELASTIC SCATTER-
  ING, SECONDARY NEUTRON ENERGY DISTRIBUTIONS WERE CALCULATED WITH
  EGNASH-2.
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20)R.H.SPEAR                AND 42,55(1989)
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MAT number = 3131

```
 31-GA- 71 KHI          EVAL-MAR94 T.WATANABE
                        DIST-APR94
HISTORY
94-3  NEWLY EVALUATED.

MF=1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF=2  RESONANCE PARAMETERS
  MT=151 RESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE PARAMETERS FOR MLBW FORMULA (BELOW 5.6KEV)
  NEGATIVE ENERGY LEVEL PARAMETERS WERE ADJUSTED TO REPRODUCE
  KOESTERS 2200M/S DATA/1/.
  RESONANCE PARAMETERD WERE EVALUATRED MAINLY BASED ON OHKUBOS
  DATA/2/ AND MUGHABGHABS COMPILATION/3/.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                       2200 M/S                RES. INTEG.
      TOTAL             8.945                     -
      ELASTIC           5.236                     -
      CAPTURE           3.709                   32.19

MF=3  NEUTRON CROSS SECTIONS
  BELOW 5.6 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 5.6 KEV, THE TOTAL, ELASTIC AND INELASTIC SCATTERING, AND
  CAPTURE CROSS SECTIONS WERE CALCULATED WITH THE OPTICAL AND
  STATISTICAL MODEL CODE CASTHY/4/.
  OPTICAL MODEL PARAMETERS USED IN CASTHY CALCUALTION WERE AS
  FOLLOWS.

              DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
         ----------------------  ------------  ---------------
     V  = 49.42-0.5867E         , R0 =  5.3541     , A0 =  0.415
     WS = 5.381+0.4117E         , RS =  5.4162     , AS =  0.456
     WSO= 8.552                 , RSO=  6.5549     , ASO=  0.648

  THE LEVEL SCHEME WAS ADOPTED FROM ENSDF FILE/5/.
           NO.      ENERGY(MEV)    SPIN-PARITY  BETA2/BETA3
           GR.       0.0             3/2 -
            1        0.3900          1/2 -        0.2
            2        0.4872          5/2 -        0.2
            3        0.5116          3/2 -        0.2
            4        0.7140         11/2 -
            5        0.9103          3/2 -        0.2
            6        0.9648          5/2 -        0.15
            7        1.1074          7/2 -        0.15
            8        1.1093          1/2 -        0.15
            9        1.3952          7/2 -        0.15
           10        1.4759          5/2 -        0.1
           11        1.4937          9/2 +        0.1
           12        1.4986          5/2 -
           13        1.6316          3/2 -
           14        1.7022          1/2 +
           15        1.7198          5/2 -
           16        1.7524          3/2 -
           17        1.9040          5/2 -
           18        1.9410          3/2 +
           19        1.9950          5/2 -
           20        2.0640          1/2 -
           21        2.1324          5/2 -
           22        2.1913          5/2 -
           23        2.2060          5/2 -
           24        2.2472          7/2 +
           25        2.2944          1/2 -
           26        2.3273          1/2 -
      LEVELS ABOVE 2.33 MEV WERE ASSUMED TO BE OVERLAPPING.

  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GIRBERT-
  CAMERON WERE EVALUATED.
  SPIN CUT-OFF PARAMETER C1 WAS TAKEN AS 0.146.

                                   GA- 71      GA- 72
                                  --------    --------
         A (MEV)                   13.000      12.900
         SPIN CUT-OFF PARAM.        9.026       9.075
         PAIRING ENERGY (MEV)       1.430       0.0
         NORMALIZATION FACTOR    1747.70     1758.60
         E-JOINT (MEV)              6.326       4.961

  THE CAPTURE CROSS SECTION WAS NORMALIZED TO 12 MB AT 1MEV TO
  REPRODUCE THE EXPERIMENTAL CAPTURE CROSS SECTION/6/.
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  ABOVE 1 MEV, DIRECT/SEMIDIRECT CAPTURE CROSS SECTION NORMALIZED
  TO 0.74MB WERE ADDED TO CASTHY'S RESULTS/7/.

  MT=16,17,22,28,32,103,104,105,106,107
     (N,2N),(N,3N),(N,NA),(N,NP),(N,ND),(N,NT),(N,P),(N,D),
     (N,T),(N,HE-3),(N,A)
  WERE EVALUATED WITH MODIFIED EGNASH-2/8/ USING F2=0.6 AND
  FOLLOWING OPTICAL POTENTIAL
     NEUTRON    :SAME AS USED IN CASTHY
     PROTON     :PEREYS OMP/9/
     DEUTRON    :LOHR-HAEBERLIS OMP/10/
     TRITON     :BECCHETTI-GREENLESS OMP/11/
     HE-3       :BECCHETTI-GREENLESS OMP/11/
     ALPHA      :LEMOS OMP/12/
  AND NORMALIZED TO FOLLOWING DATA.
     (N,2N)    950.0    MB      CSIKAI'S DATA/13/
     (N,NA)      2.4    MB      QAIMS DATA/14/
     (N,NP)      1.95   MB      SYSTEMATICS/15/
     (N,P)      20.5    MB      QAIMS DATA/16/
     (N,D)       3.63   MB      SYSTEMATICS
     (N,T)       0.33   MB      SYSTEMATICS
     (N,A)       3.5    MB      MEASURED DATA/17,18/

  THE MU-BAR(MT=251) WAS ALSO CALCULATED WITH CASTHY.

MF=4  MT=2,16,17,22,28,32,51-76,91
  (N,2N),(N,NA),(N,NP),(N,ND) AND ELASTIC AND INELASTIC SCATTERING
  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  ANGULAR DISTRIBUTIONS WERE CALCULATED WITH CASTHY FOR ELA-
  STICALLY AND INELASTICALLY SCATTERED NEUTRONS.
  DIRECT INELASTIC SCATTERING CONTRIBUTIONS WERE EVALUATED WITH
  DWUCKY/19/ AND ADDED TO CASTHY'S RESULTS.
  DEFORMATION PARAMETERS USED IN THE DWUCKY CALCULATION WAS
  EVALUATED FROM COMPILATION/20,21/ AND ENSDF HALF LIFE DATA.
  AS FOR (N,2N),(N,3N),(N,NA),(N,NP) AND (N,ND),ISOTROPIC
  DISTRIBUTIONS WERE ASSUMED.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,22,28,32,91
  FOR (N,2N),(N,3N),(N,NA),(N,NP),(N,ND) AND CONTINUM INELASTIC
  SCATTERING, SECONDARY NEUTRON ENERGY DISTRIBUTIONS WERE
  CALCULATED WITH EGNASH-2.
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REFERENCES
 1)L.KOESTER ET. AL.        Z.PHYS. A318,347(1984)
 2)M.OHKUBO ET. AL.         JAERI-M 90-213(1990)
 3)S.F.MUGHABGHAB ET. AL.,  NEUTRON CROSS SECTION VOL.1 PART A
                            ACADEMIC PRESS(1981)
 4)S.IGARASHI,T.FUKAHORI    JAERI-1321     (1991)
 5)EVALUATED NUCLEAR STRUCTURAL DATA FILE
 6)G.G.ZAIKIN ET AL.        UFZ 16,1205(1971)
 7)T.NAKAGAWA               CAPDIR MANUAL
 8)N.YAMAMURO               JAERI-M 90-006(1991)
 9)F.G.PEREY                PR    131, 745(1963)
10)J.M.LOHR,W.HAEBERLI      NP   A232, 381(1974)
11)F.D.BECCHETTI  AND       POLARIZATION PHENOMENA IN NUCLEAR
     G.W.GREENLESS          REACTION   682(1971) UNIV. WISCONSIN
12)O.F.LEMOS                ORSAY REP.SER.A NO.136(1972)
13)J.CSIKAI ET AL.          AHP 23,87(1967)
14)S.M.QAIM ET AL.          EUR-5182E,939'1974)
15)R.A.FORREST              AERE-R 12419(1986)
16)S.M.QAIM ET AL           NP/A 283,269(1977)
17)K.KAWADE ET.AL.          JAERI-M 90-171(1990)
18)S.M.QAIM                 14 MEV ACTIVATION CROSS SECTIONS
                            HANDBOOK OF SPECTROSCOPY,VOL.3 P.141
                            CRC PRESS BOCA RATON FLORIDA,1981
19)N.YAMAMURO               JAERI-M 88-140(1988)
20)S.RAMAN ET.AL.           AND 42,1(1989
21)R.H.SPEAR                AND 42,55(1989)
```

MAT number = 3200

32-GE- 0 KHI EVAL-MAR94 T.WATANABE
DIST-APR94

HISTORY
94-3 NEW EVALUATION WAS CONSTRUCTED FROM ISOTOPES DATA.

MF=1 GENERAL INFORMATION
MT=451 COMMENTS AND DICTIONARY

MF=2 RESONANCE PARAMETERS
MT=151 RESOLVED RESONANCE PARAMETERS
RESOLVED RESONANCE PARAMETERS FOR MLBW FORMULA (BELOW 62.0KEV)
THE DATA WERE CONSTRUCTED FROM THE EVALUATED RESONANCE
PARAMETERS FOR GE ISOTOPES CONSIDERING THEIR ABUNDANCIES/1/.

CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)

	2200 M/S	RES. INTEG.
TOTAL	10.62	-
ELASTIC	8.51	-
CAPTURE	2.11	5.88

MF=3 NEUTRON CROSS SECTIONS
BELOW 62 KEV, RESONANCE PARAMETERS WERE GIVEN.
ABOVE 8.5 KEV, THE TOTAL, ELASTIC AND INELASTIC SCATTERING, AND
CAPTURE CROSS SECTION WERE GIVEN AS BACKGROUND OR SMOOTH CROSS
SECTION.
THE DATA WERE CONSTRUCTED FROM THE EVALUATED CROSS SECTIONS
FOR EACH GE ISOTOPE CONSIDERING THEIR ABUNDANCIES.

MT=16,22,28,32,102,103,104,105,106,107,111,251
(N,2N),(N,NA),(N,NP),(N,ND),(N,P),(N,D),(N,T),(N,HE-3),
(N,A),(N,2P),MU-BAR
WERE CONSTRUCTED FROM EACH GE ISOTOPE DATA CONSIDERING
ABUNDANCES.
CROSS SECTIONS FOR EACH ISOTOPE WERE EVALUATED USING CASTHY/2/
AND MODIFIED EGNASH-2/3/ PROGRAMM.
USED NEUTRON OPTICAL MODEL PARAMETERS WERE AS FOLLOWS.

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 52.07-0.7434E	, R0 = 1.224	, A0 = 0.492
WS = 9.997+0.1299E	, RS = 1.411	, AS = 0.36
WSO= 10.99	, RSO= 1.470	, ASO= 0.65

THE LEVEL SCHEME WAS ADOPTED FROM ENSDF FILE.

NO.	ENERGY (MEV)	GE-70	GE-72	GE-73	GE-74	GE-76
GR.	0.000	GR	GR	GR	GR	GR
1	0.013			1		
2	0.067			2, 3		
3	0.354			4, 5, 6		
4	0.499			7, 8		
5	0.551			9,10		1
6	0.596			11,12	1	
7	0.692		1			
8	0.742			13,14		
9	0.809			15,16		
10	0.834		2	17		
11	0.894			18-21		
12	0.994			22,23		
13	1.039	1		24		
14	1.108			25,26		2
15	1.204	2			2	
16	1.410					3
17	1.464		3		3, 4	
18	1.539					4
19	1.697	3	4		5, 6	
20	1.911				7	5, 6
21	2.029		5- 7			
22	2.153	4, 5			8, 9	
23	2.198				10,11	7, 8
24	2.307	6				
25	2.396		8, 9			
26	2.452	7	10			9,10
27	2.536	8	11		12	
28	2.561	9	12		13,14	11,12
29	2.670				15-17	13-15
30	2.753		13,14		18	16
31	2.807	10			19-21	17
32	2.876	11	15,16			18,19
33	2.926	12	17-19		22-24	

34	2.974			25	20
35	3.034	13-15	20-24		21,22
36	3.181	16-18			
37	3.297	19-22			
38	3.423	23	25	26	23
39	4.0	24	26	27	24

LEVELS ABOVE 1.14 MEV WERE ASSUMED TO BE OVERLAPPING.

PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GIRBERT-CAMERON WERE EVALUATED.
SPIN CUT-OFF PARAMETER C1 WAS TAKEN AS 0.146.

	A(MEV)	SPIN CUT-OFF PARAM.	PAIRING EN.(MEV)	NORMAL. FACTOR	E-JOINT (MEV)
GE-70	13.430	9.088	2.860	1780.00	8.234
GE-71	13.600	9.232	1.360	1828.30	8.064
GE-72	15.020	9.793	2.790	2047.70	7.841
GE-73	14.970	9.867	1.360	2069.20	7.828
GE-74	13.550	9.473	3.240	1898.60	10.660
GE-75	13.500	9.540	1.360	1917.20	7.654
GE-76	14.230	9.882	2.830	2047.70	8.586
GE-77	14.200	9.871	1.360	2043.40	6.872

MF=4 MT=2,16,22,28,32,51-89,91
(N,2N),(N,NA),(N,NP),(N,ND) AND ELASTIC AND INELASTIC SCATTERING ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CONSTRUCTED FROM EACH GE ISOTOPE DATA CONSIDERING ABUNDANCES.

MF=5 MT=16,22,28,32,91
(N,2N),(N,NA),(N,NP),(N,ND) AND CONTINUUM INELASTIC SCATTERING ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CONSTRUCTED FROM EACH GE ISOTOPE DATA CONSIDERING ABUNDANCES.

REFERENCES

1)C.M.LEDERER ET.AL.   TABLE OF ISOTOPES 7TH ED.(1978) JOHN WILEY & SONS INC.
2)S.IGARASHI,T.FUKAHORI   JAERI-1321   (1991)
3)N.YAMAMURO   JAERI-M 90-006(1991)

MAT number = 3225

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 32-GE- 70 KHI           EVAL-MAR94 T.WATANABE
                         DIST-APR94
HISTORY
94-3  NEWLY EVALUATED

MF=1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF=2  RESONANCE PARAMETERS
  MT=151 RESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE PARAMETERS FOR MLBW FORMULA (BELOW 15 KEV)
  NEGATIVE ENERGY LEVEL PARAMETERS WERE ADJUSTED TO REPRODUCE
  KOESTERS 2200M/S DATA/1/.
  PARAMETERS WERE EVALUATED MAINLY BASED ON MUGHABGHABS
  COMPILATION/2/.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S                RES. INTEG.
      TOTAL           15.43                      -
      ELASTIC         12.5                       -
      CAPTURE          2.93                    2.51

MF=3  NEUTRON CROSS SECTIONS
  BELOW  15 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE  15 KEV, THE TOTAL, ELASTIC AND INELASTIC SCATTERING, AND
  CAPTURE CROSS SECTIONS WERE CALCULATED WITH THE OPTICAL AND
  STATISTICAL MODEL CODE CASTHY/3/.
  OPTICAL MODEL PARAMETERS USED IN CASTHY CALCULATION WERE AS
  FOLLOWS.

                DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
         ----------------------  ------------  ---------------
     V  = 52.07-0.7434E         , R0 =  5.0445     , A0 =  0.492
     WS = 9.997+0.1299E         , RS =  5.8151     , AS =  0.36
     WSO= 10.99                 , RSO=  6.0583     , ASO=  0.65

  THE LEVEL SCHEME WAS ADOPTED FROM ENSDF FILE/4/.
           NO.      ENERGY(MEV)    SPIN-PARITY       BETA 2/3
           GR.       0.0000          0  +
            1        1.0392          2  +            0.16
            2        1.2154          0  +
            3        1.7079          2  +            0.12
            4        2.1534          4  +
            5        2.1574          2  +            0.12
            6        2.3069          0  +
            7        2.4515          3  +
            8        2.5358          2  +
            9        2.5614          3  -            0.11
           10        2.8067          4  +
           11        2.8877          0  +
           12        2.9452          2  +            0.11
           13        3.0468          3  +
           14        3.0588          4  +
           15        3.1070          0  +
           16        3.1810          2  +
           17        3.1942          4  +
           18        3.2420          1  +
           19        3.2966          3  +
           20        3.2973          6  +
           21        3.3718          3  +
           22        3.4165          5  -
           23        3.4230          2  +            0.11
           24        4.0000          2  +            0.11(DUMMY)
      LEVELS ABOVE 3.43 MEV WERE ASSUMED TO BE OVERLAPPING.

  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GIRBERT-
  CAMERON WERE EVALUATED.
  SPIN CUT-OFF PARAMETER C1 WAS TAKEN AS 0.146.

                                 GE- 70      GE- 71
                                --------    --------
         A (MEV)                 13.430      13.600
         SPIN CUT-OFF PARAM.      9.088       9.232
         PAIRING ENERGY (MEV)     2.860       1.360
         NORMALIZATION FACTOR   1780.00     1828.30
         E-JOINT (MEV)            8.234       8.064

  THE CAPTURE CROSS SECTION WAS ADJUSTED TO 45 MILLIBARN S AT
  200 KEV/5/.
  ABOVE 1MEV, DIRECT/SEMIDIRECT CAPTURE CROSS SECTION NORMALIZED
  TO 0.77MB AT 14MEV, WERE ADDED TO CASTHYS RESULTS/6/.
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    MT=16,22,28,103,104,105,106,107,111
       (N,2N),(N,NA),(N,NP),(N,P),(N,D),(N,T),(N,HE-3),
       (N,A),(N,2P)
    WERE EVALUATED WITH MODIFIED EGNASH-2/7/ USING F2=1.2 AND
    FOLLOWING OPTICAL POTENTIAL
       NEUTRON    :SAME AS USED IN CASTHY
       PROTON     :PEREYS OMP/8/
       DEUTRON    :LOHR-HAEBERLIS OMP/9/
       TRITON     :BECCHETTI-GREENLESS OMP/10/
       HE-3       :BECCHETTI-GREENLESS OMP/10/
       ALPHA      :LEMOS OMP/11/
    AND NORMALIZED TO THE FOLLOWING DATA.
       (N,2N)       500.0    MB    KONNO'S EXP. DATA/12/
       (N,NP)        48.0    MB    SYSTEMATICS/13/
       (N,P)         96.0    MB    AV. OF /14/,/15/ AND /16/
       (N,D)          7.9    MB    SYSTEMATICS
       (N,A)         30.0    MB    SYSTEMATICS

    THE MU-BAR(MT=251) WAS ALSO CALCULATED WITH CASTHY.

  MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
    MT=2,16,22,28,51-74,91
    ELASTIC AND INELASTIC SCATTERING CROSS SECTION,(N,2N),(N,NA)
    AND (N,NP)
    ANGULAR DISTRIBUTIONS WERE CALCULATED WITH CASTHY FOR ELA-
    STICALLY AND INELASTICALLY SCATTERED NEUTRONS.  THE DIRECT
    INELASTIC SCATTERING CONTRIBUTION WERE EVALUATED WITH
    DWUCKY PROGRAMM/17/. DEFORMATION PARAMETERS USED IN DWUCKY
    CALCUALTION WERE EVALUATED FROM COMPILATIONS/18,19/ AND
    ENSDF HALF LIFE DATA AND ADJUSTED TO REPRODUCE
    DDX DATA/20/.
    AS FOR (N,2N),(N,NA),(N,NP) AND (N,ND),ISOTROPIC DISTRIBUTION
    WAS ASSUMED.

  MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
    MT=16,22,28,91
    FOR (N,2N),(N,NA),(N,NP) AND CONTINUM INELSTIC SCATTERING
    SECONDARY NEUTRON ENERGY DISTRIBUTION WAS CALCULATED WITH
    EGNASH-2.
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  REFERENCES
   1)L.KOESTER ET. AL.          Z.PHYS. A327,129(1987)
   2)S.F.MUGHABGHAB ET. AL.,    NEUTRON CROSS SECTION VOL.1 PART A
                                ACADEMIC PRESS(1981)
   3)S.IGARASHI,T.FUKAHORI      JAERI-1321     (1991)
   4)EVALUATED NUCLEAR STRUCTURAL DATA FILE
   5)G. WALTERS                 KFK-3706(1984)
   6)T. NAKAGAWA                CAPDIR MANUAL
   7)N.YAMAMURO                 JAERI-M 90-006(1991)
   8)F.G.PEREY                  PR     131, 745(1963)
   9)J.M.LOHR,W.HAEBERLI        NP   A232, 381(1974)
  10)F.D.BECCHETTI  AND         POLARIZATION PHENOMENA IN NUCLEAR
     G.W.GREENLESS              REACTION   682(1971) UNIV. WISCONSIN
  11)O.F.LEMOS                  ORSAY REP.SER.A NO.136(1972)
  12)KONNO   ET.AL.             JAERI-1329(1993)
  13)R.A.FORREST                AERE-R 12419(1986)
  14)H.M.HOANG ET AL            ZP.A342,283(1992)
  15)J.L.CASANOVA ET AL.        ARS,72,(3),186(1976)
  16)G.P.VINITSKAYA ET AL.      NESTOR LIST
  17)N.YAMAMURO                 JAERI-M 88-140(1988)
  18)S.RAMAN ET AL.             AND 42,1(1989)
  19)R.H.SPEAR                  AND 42,55(1989)
  20)A.TAKAHASHI ET.AL.         OKTAVIAN DATA PRIVATE COM.
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MAT number = 3231

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 32-GE- 72 KHI          EVAL-MAR94 T.WATANABE
                        DIST-APR94
HISTORY
94-3  NEWLY EVALUATED.

MF=1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF=2  RESONANCE PARAMETERS
  MT=151 RESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE PARAMETERS FOR MLBW FORMULA (BELOW 40KEV )
  NEGATIVE ENERGY LEVEL PARAMETERS WERE ADJUSTED TO REPRODUCE
  KOESTERS 2200M/S DATA/1/.
  LEVEL PARAMETERS WERE EVALUATED MAINLY BASED ON MUGHABGHABS
  COMPILATION/2/.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           9.91                     -
      ELASTIC         9.1                      -                3
      CAPTURE         0.81                   0.87

MF=3  NEUTRON CROSS SECTIONS
  BELOW  40 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE  40 KEV, THE TOTAL, ELASTIC AND INELASTIC SCATTERING, AND
  CAPTURE CROSS SECTIONS WERE CALCULATED WITH THE OPTICAL AND
  STATISTICAL MODEL CODE CASTHY /3/.
  OPTICAL MODEL PARAMETERS USED IN CASTHY CALCULATION WERE AS
  FOLLOWS.

              DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
         ----------------------  ------------  ---------------
     V  = 52.07-0.7434E         , R0 =  5.092      , A0 =  0.492
     WS = 9.997+0.1299E         , RS =  5.87       , AS =  0.36
     WSO= 10.99                 , RSO=  6.1154     , ASO=  0.65

  THE LEVEL SCHEME WAS ADOPTED FROM ENSDF FILE/4/.
           NO.      ENERGY(MEV)    SPIN-PARITY      BETA 2/3
           GR.       0.0000          0  +
            1        0.6916          0  +
            2        0.8341          2  +           0.16
            3        1.4641          2  +           0.12
            4        1.7284          4  +
            5        2.0290          0  +
            6        2.0490          0  +
            7        2.0650          3  +
            8        2.3962          1  +
            9        2.4024          2  +           0.12
           10        2.4640          4  +
           11        2.5149          3  -           0.11
           12        2.5835          1  +
           13        2.7544          0  +
           14        2.7722          6  +
           15        2.8757          2  +
           16        2.8970          0  +
           17        2.9401          1  -
           18        2.9436          3  -
           19        2.9504          1  +
           20        3.0340          2  +
           21        3.0358          2  -
           22        3.0805          4  +
           23        3.0942          2  +           0.11
           24        3.1290          5  -
           25        3.5000          2  +           0.11(DUMMY)
           26        4.0000          2  +           0.11(DUMMY)
      LEVELS ABOVE 3.26 MEV WERE ASSUMED TO BE OVERLAPPING.

  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GIRBERT-
  CAMERON WERE EVALUATED.
  SPIN CUT-OFF PARAMETER C1 WAS TAKEN AS 0.146.

                                   GE- 72      GE- 73
                                  --------    --------
          A (MEV)                  15.020      14.970
          SPIN CUT-OFF PARAM.       9.793       9.867
          PAIRING ENERGY (MEV)      2.790       1.360
          NORMALIZATION FACTOR    2047.70     2069.20
          E-JOINT (MEV)             7.841       7.828

  THE CAPTURE CROSS SECTION WAS NORMALIZED USING D0=962 EV AND
  GG=0.162 EV ADOPTED FROM MUGHABGHABS COMPILATION/2/.
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ABOVE 1 MEV, DIRECT/SEMIDIRECT CAPTURE CROSS SECTION NORMALIZED
TO 0.76MB AT 14 MEV WERE ADDED TO CASTHYS RESULTS/5/.

MT=16,17,22,28,32,103,104,105,106,107
(N,2N),(N,3N),(N,NA),(N,NP),(N,ND),(N,P),(N,D),(N,T),
(N,HE-3),(N,A)
WERE EVALUATED WITH MODIFIED EGNASH-2/6/ USING F2=1.4 AND
FOLLOWING OPTICAL POTENTIAL

NEUTRON	:SAME AS USED IN CASTHY
PROTON	:PEREYS OMP/7/
DEUTRON	:LOHR-HAEBERLIS OMP/8/
TRITON	:BECCHETTI-GREENLESS OMP/9/
HE-3	:BECCHETTI-GREENLESS OMP/9/
ALPHA	:LEMOS OMP/10/

AND NORMALIZED TO FOLLOWING DATA.

(N,NA)	1.6	MB	SYSTEMATICS/11/
(N,NP)	5.7	MB	SYSTEMATICS
(N,P)	33.4	MB	AV.EXP.DATA/12,13/
(N,D)	5.3	MB	SYSTEMATICS
(N,T)	0.026	MB	SYSTEMATICS
(N,A)	14.0	MB	AV. EXP. DATA/13,14/

THE MU-BAR(MT=251) WAS ALSO CALCULATED WITH CASTHY.

MF=4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=2,16,22,28,32,51-76,91
ELASTIC AND INELASTIC SCATTERING CROSS SECTION,(N,2N),(N,NA),
(N,NP) AND (N,ND)
ANGULAR DISTRIBUTIONS WERE CALCULATED WITH CASTHY FOR ELA-
STICALLY AND INELASTICALLY SCATTERED NEUTRONS. THE DIRECT
INELASTIC SCATTERING CONTRIBUTION WERE EVALUATED WITH
DWUCKY PROGRAMM/15/. DEFORMATION PARAMETERS USED IN DWUCKY
CALCUALTION WERE EVALUATED FROM COMPILATIONS/16,17/ AND
ENSDF HALF LIFE DATA AND ADJUSTED TO REPRODUCE
DDX DATA/18/.
AS FOR (N,2N),(N,NA),(N,NP) AND (N,ND),ISOTROPIC DISTRIBUTION
WAS ASSUMED.

MF=5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=16,22,28,32,91
FOR (N,2N),(N,NA),(N,NP),(N,ND) AND CONTINUM INELASTIC SCATTER-
ING, SECONDARY NEUTRON ENERGY DISTRIBUTIONS WERE CALCULATED
WITH EGNASH-2.

REFERENCES

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2)S.F.MUGHABGHAB ET. AL., NEUTRON CROSS SECTION VOL.1 PART A ACADEMIC PRESS(1981)
3)S.IGARASHI,T.FUKAHORI JAERI-1321 (1991)
4)EVALUATED NUCLEAR STRUCTURAL DATA FILE
5)T.NAKAGAWA CAPDIR MANUAL
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7)F.G.PEREY PR 131, 745(1963)
8)J.M.LOHR,W.HAEBERLI NP A232, 381(1974)
9)F.D.BECCHETTI AND G.W.GREENLESS POLARIZATION PHENOMENA IN NUCLEAR REACTION 682(1971) UNIV. WISCONSIN
10)O.F.LEMOS ORSAY REP.SER.A NO.136(1972)
11)R.A.FORREST AERE-R 12419(1986)
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13)J.L.CASANOVA ET AL. ARS 72,186(1976)
14)G.P.VINITSKAYA ET AL. VINITSKAYA (1968) ACC.NO.=40009012
15)N.YAMAMURO JAERI-M 88-140(1988)
16)S.RAMAN ET AL. AND 42,1(1989)
17)R.H.SPEAR AND 42,55(1989)
18)A.TAKAHASHI ET.AL. OKATVIAN DATA PRIVATE COM.

MAT number = 3234

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 32-GE- 73 KHI          EVAL-MAR94 T.WATANABE
                        DIST-APR94
HISTORY
94-3  NEWLY EVALUATED

MF=1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF=2  RESONANCE PARAMETERS
  MT=151 RESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE PARAMETERS FOR MLBW FORMULA (BELOW 8.53 KEV)
  NEGATIVE ENERGY LEVEL PARAMETERS WERE ADJUSTED TO REPRODUCE
  KOESTERS 2200M/S DATA/1/.
  LEVEL PARAMETERS WERE EVALUATED MAINLY BASED ON MUGHABGHABS
  COMPILATION/2/.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                   2200 M/S               RES. INTEG.
      TOTAL        19.2                      -
      ELASTIC       4.8                      -
      CAPTURE      14.4                    62.3

MF=3  NEUTRON CROSS SECTIONS
  BELOW 8.53KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 8.53KEV, THE TOTAL, ELASTIC AND INELASTIC SCATTERING, AND
  CAPTURE CROSS SECTIONS WERE CALCULATED WITH THE OPTICAL AND
  STATISTICAL MODEL CODE CASTHY /3/.
  OPTICAL MODEL PARAMETERS USED IN CASTHY CALCULATION WERE AS
  FOLLOWS.

              DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
        ----------------------  ------------  ---------------
     V  = 52.07-0.7434E        , R0 =  5.1155     , A0 =  0.492
     WS = 9.997+0.1299E        , RS =  5.897      , AS =  0.36
     WSO= 10.99                , RSO=  6.1436     , ASO=  0.65

  THE LEVEL SCHEME WAS ADOPTED FROM ENSDF FILE/4/.
           NO.      ENERGY(MEV)    SPIN-PARITY  BETA2/BETA3
           GR.       0.0000          9/2 +
            1        0.0133          5/2 +       0.17
            2        0.0667          1/2 -       0.13
            3        0.0688          7/2 +       0.13
            4        0.3536          5/2 -       0.13
            5        0.3640          3/2 -       0.11
            6        0.3925          3/2 -       0.11
            7        0.4991          7/2 +       0.11
            8        0.5015          5/2 +       0.1
            9        0.5511          5/2 +       0.1
           10        0.5549          1/2 +       0.1
           11        0.5976          5/2 -
           12        0.6590          9/2 +
           13        0.7417          7/2 -
           14        0.7770          3/2 +
           15        0.8090          5/2 -
           16        0.8258         13/2 +
           17        0.8680         11/2 +
           18        0.8941          1/2 -
           19        0.9040          1/2 -
           20        0.9155          3/2 +
           21        0.9317          5/2 +
           22        0.9937         11/2 +
           23        1.0260         13/2 +
           24        1.0432          3/2 -
           25        1.1305          9/2 -
           26        1.1319          1/2 -
      LEVELS ABOVE 1.14 MEV WERE ASSUMED TO BE OVERLAPPING.

  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GIRBERT-
  CAMERON WERE EVALUATED.
  SPIN CUT-OFF PARAMETER C1 WAS TAKEN AS 0.146.

                                 GE- 73     GE- 74
                                --------   --------
        A (MEV)                  14.970     13.550
        SPIN CUT-OFF PARAM.       9.867      9.473
        PAIRING ENERGY (MEV)      1.360      3.240
        NORMALIZATION FACTOR    2069.20    1898.60
        E-JOINT (MEV)             7.828     10.660

  THE CAPTURE CROSS SECTION WERE NORMALIZED USING D0=82 EV AND
  GG=0.145 EV, ADOPTED FROM MUGHABGHABS COMPILATION/2/.
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  ABOVE 1 MEV,DIRECT/SEMIDIRECT CAPTURE CROSS SECTION NORMALIZED
  TO 0.76MB AT 14 MEV WERE ADDED TO CASTHYS RESULTS/5/.

  MT=16,17,22,28,32,103,104,105,106,107
     (N,2N),(N,3N),(N,NA),(N,NP),(N,ND),(N,P),(N,D),(N,T),
     (N,HE-3),(N,A)
  WERE EVALUATED WITH MODIFIED EGNASH-2/6/ USING F2=1.2 AND
  FOLLOWING OPTICAL POTENTIAL
     NEUTRON    :SAME AS USED IN CASTHY
     PROTON     :PEREYS OMP/7/
     DEUTRON    :LOHR-HAEBERLIS OMP/8/
     TRITON     :BECCHETTI-GREENLESS OMP/9/
     HE-3       :BECCHETTI-GREENLESS OMP/9/
     ALPHA      :LEMOS OMP/10/
  AND NORMALIZED TO FOLLOWING DATA.
     (N,NA)       0.97   MB       SYSTEMATICS/11/
     (N,P)       20.7    MB       KONNO'S EXP. DATA/12/
     (N,D+NP)     4.77   MB       KONNO'S EXP. DATA/12/
     (N,T)        0.36   MB       SYSTEMATICS
     (N,A)        7.79   MB       SYSTEMATICS

  THE MU-BAR(MT=251) WAS ALSO CALCULATED WITH CASTHY.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,16,17,22,28,32,51-76,91
  ELASTIC AND INELASTIC SCATTERING CROSS SECTION,(N,2N),(N,3N),
  (N,NA),(N,NP) AND (N,ND)
  ANGULAR DISTRIBUTIONS WERE CALCULATED WITH CASTHY FOR ELA-
  STICALLY AND INELASTICALLY SCATTERED NEUTRONS.  THE DIRECT
  INELASTIC SCATTERING CONTRIBUTION WERE EVALUATED WITH
  DWUCKY PROGRAMM/13/. DEFORMATION PARAMETERS USED IN DWUCKY
  CALCULATION WERE EVALUATED FROM COMPILATIONS/14,15/ AND
  HALF LIFE DATA FROM ENSDF AND ADJUSTED TO REPRODUCE
  DDX DATA/16/.
  AS FOR (N,2N),(N,3N),(N,NA),(N,NP) AND (N,ND),ISOTROPIC
  DISTRIBUTIONS WAS ASSUMED.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,22,28,32,91
  FOR (N,2N),(N,3N),(N,NA),(N,NP),(N,ND) AND CONTINUM INELASTIC
  SCATTERING,SECONDARY NEUTRON ENERGY DISTRIBUTIONS WERE
  CALCULATED WITH EGNASH-2.
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REFERENCES
 1)L.KOESTER ET. AL.         Z.PHYS. A327,129(1987)
 2)S.F.MUGHABGHAB ET. AL.,  NEUTRON CROSS SECTION VOL.1 PART A
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 3)S.IGARASHI,T.FUKAHORI    JAERI-1321     (1991)
 4)EVALUATED NUCLEAR STRUCTURAL DATA FILE
 5)T.NAKAGAWA                CAPDIR MANUAL
 6)N.YAMAMURO                JAERI-M 90-006(1991)
 7)F.G.PEREY                 PR     131, 745(1963)
 8)J.M.LOHR,W.HAEBERLI       NP   A232, 381(1974)
 9)F.D.BECCHETTI  AND        POLARIZATION PHENOMENA IN NUCLEAR
     G.W.GREENLESS           REACTION   682(1971) UNIV. WISCONSIN
10)O.F.LEMOS                 ORSAY REP.SER.A NO.136(1972)
11)R.A.FORREST               AERE-R 12419(1986)
12)C.KONNO ET AL             JAERI-1329(1993)
13)N.YAMAMURO                JAERI-M 88-140(1988)
14)S.RAMAN ET AL.            AND 42,1(1989)
15)R.H.SPEAR                 AND 42,55(1989)
16)A.TAKAHASHI ET.AL.        OKTAVIAN DATA PRIVATE COM.
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MAT number = 3237

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 32-GE- 74 KHI          EVAL-MAR94 T.WATANABE
                        DIST-APR94
HISTORY
94-3  NEWLY EVALUATED.

MF=1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF=2  RESONANCE PARAMETERS
  MT=151 RESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE PARAMETERS FOR MLBW FORMULA (BELOW 62.0 KEV)
  NEGATIVE ENERGY LEVEL PARAMETERS WERE ADJUSTED TO REPRODUCE
  KOESTERS 2200M/S DATA/1/.
  LEVEL PARAMETERS WERE EVALUATED MAINLY BASED ON MUGHABGHABS
  COMPILATION/2/.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S                RES. INTEG.
      TOTAL           7.2                        -
      ELASTIC         6.8                        -
      CAPTURE         0.42                     0.46

MF=3  NEUTRON CROSS SECTIONS
  BELOW  62 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE  62 KEV, THE TOTAL, ELASTIC AND INELASTIC SCATTERING, AND
  CAPTURE CROSS SECTIONS WERE CALCULATED WITH THE OPTICAL AND
  STATISTICAL MODEL CODE CASTHY /3/.
  OPTICAL MODEL PARAMETERS USED IN CASTHY CALCULATION WERE AS
  FOLLOWS.

              DEPTH (MEV)       RADIUS(FM)   DIFFUSENESS(FM)
         ----------------------  ------------ ---------------
     V  = 52.07-0.7434E         , R0 =  5.1388     , A0 =  0.492
     WS = 9.997+0.1299E         , RS =  5.9239     , AS =  0.36
     WSO= 10.99                 , RSO=  6.1716     , ASO=  0.65

  THE LEVEL SCHEME WAS ADOPTED FROM ENSDF FILE/4/.
           NO.      ENERGY(MEV)    SPIN-PARITY     BETA 2/3
           GR.       0.0000         0  +
            1        0.5959         2  +           0.16
            2        1.2042         2  +           0.12
            3        1.4638         4  +
            4        1.4828         0  +
            5        1.6971         3  +
            6        1.7250         0  +
            7        1.9130         0  +
            8        2.1650         1  -
            9        2.1653         3  +
           10        2.1980         2  +           0.11
           11        2.2277         0  +
           12        2.5363         3  -           0.11
           13        2.5693         4  +
           14        2.6002         1  -
           15        2.6696         4  +
           16        2.6938         2  +
           17        2.6969         2  +
           18        2.7530         0  +
           19        2.8285         4  +
           20        2.8359         2  +
           21        2.8440         3  -
           22        2.9255         2  +
           23        2.9355         4  -
           24        2.9491         2  -
           25        2.9735         2  +           0.11
           26        3.5000         2  +           0.1
           27        4.0000         2  +           0.1
      LEVELS ABOVE 3.02 MEV WERE ASSUMED TO BE OVERLAPPING.

  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GIRBERT-
  CAMERON WERE EVALUATED.
  SPIN CUT-OFF PARAMETER C1 WAS TAKEN AS 0.146.

                                 GE- 74      GE- 75
                                --------    --------
          A (MEV)                13.550      13.500
          SPIN CUT-OFF PARAM.     9.473       9.540
          PAIRING ENERGY (MEV)    3.240       1.360
          NORMALIZATION FACTOR  1898.60     1917.20
          E-JOINT (MEV)          10.660       7.654

  THE CAPTURE CROSS SECTION WERE NORMALIZED TO 26 MILLI-
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   BARNS AT 50KEV/5/.
   ABOVE 1 MEV, DIRECT/SEMIDIRECT CAPTURE CROSS SECTION NORMALIZED
   TO 0.77MB AT 14 MEV, WERE ADDED TO CASTHYS RESULT/6/.

   MT=16,17,22,28,103,104,105,107
      (N,2N),(N,3N),(N,NA),(N,NP),(N,P),(N,D),(N,T),(N,A)
   WERE EVALUATED WITH MODIFIED EGNASH-2/7/ USING F2=1.2 AND
   FOLLOWING OPTICAL POTENTIAL
      NEUTRON   :SAME AS USED IN CASTHY
      PROTON    :PEREYS OMP/8/
      DEUTRON   :LOHR-HAEBERLIS OMP/9/
      TRITON    :BECCHETTI-GREENLESS OMP/10/
      HE-3      :BECCHETTI-GREENLESS OMP/10/
      ALPHA     :LEMOS OMP/11/
   AND NORMALIZED TO FOLLOWING DATA.
      (N,NA)      0.6    MB      SYSTEMATICS/12/
      (N,NP)      0.67   MB      WEBBERS DATA/13/
      (N,P)      11.5    MB      AV.EXP DATA/14,15/
      (N,D)       2.0    MB      KONNO'S DATA/18/-EXP.DATA/13/
      (N,A)      18.0    MB      AV.EXP.DATA/16,17/

   THE MU-BAR(MT=251) WAS ALSO CALCULATED WITH CASTHY.

 MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
   MT=2,16,17,22,28,51-77,91
   ELASTIC AND INELASTIC SCATTERING CROSS SECTION,(N,2N),(N,3N),
   (N,NA) AND (N,NP)
   ANGULAR DISTRIBUTIONS WERE CALCULATED WITH CASTHY FOR ELA-
   STICALLY AND INELASTICALLY SCATTERED NEUTRONS.  THE DIRECT
   INELASTIC SCATTERING CONTRIBUTION WERE EVALUATED WITH
   DWUCKY PROGRAMM/19/. DEFORMATION PARAMETERS USED IN DWUCKY
   CALCULATION WERE EVALUATED FROM COMPILATIONS/20,21/ AND
   ENSDF HALF LIFE DATA AND ADJUSTED TO REPRODUCE DDX DATA/22/.
   AS FOR (N,2N),(N,3N),(N,NA) AND (N,NP),ISOTROPIC DISTRIBUTIONS
   WAS ASSUMED.

 MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
   MT=16,17,22,28,91
   FOR (N,2N),(N,3N),(N,NA),(N,NP) AND CONTINUM INELASTIC SCATTER-
   ING, SECONDARY NEUTRON ENERGY DISTRIBUTIONS WERE CALCULATED
   WITH EGNASH-2.

 REFERENCES
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  3)S.IGARASHI,T.FUKAHORI    JAERI-1321     (1991)
  4)EVALUATED NUCLEAR STRUCTURAL DATA FILE
  5)V.A.TOLSTIKOV            YFI-6.5 (1968)
  6)T.NAKAGAWA               CAPDIR MANUAL
  7)N.YAMAMURO               JAERI-M 90-006(1991)
  8)F.G.PEREY                PR    131, 745(1963)
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    G.W.GREENLESS            REACTION   682(1971) UNIV. WISCONSIN
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 21)R.H.SPEAR                AND 42,55(1989)
 22)A.TAKAHASHI ET.AL.       OKTAVIAN DATA PRIVATE COM.
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MAT number = 3243

```
 32-GE- 76 KHI          EVAL-MAR94 T.WATANABE
                        DIST-APR94
HISTORY
94-3  NEWLY EVALUATED.

MF=1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF=2  RESONANCE PARAMETERS
  MT=151 RESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE PARAMETERS FOR MLBW FORMULA (BELOW 50.0 KEV)
  NEGATIVE ENERGY LEVEL PARAMETERS WERE ADJUSTED TO REPRODUCE
  KOESTERS 2200 M/S DATA/1/.
  LEVEL PARAMETERS WERE EVALUATED MAINLY BASED ON MUGHABGHABS
  COMPILATION/2/.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           7.86                      -
      ELASTIC         7.71                      -
      CAPTURE         0.15                    1.32

MF=3  NEUTRON CROSS SECTIONS
  BELOW  50 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE  50 KEV, THE TOTAL, ELASTIC AND INELASTIC SCATTERING, AND
  CAPTURE CROSS SECTIONS WERE CALCULATED WITH THE OPTICAL AND
  STATISTICAL MODEL CODE CASTHY /3/.
  OPTICAL MODEL PARAMETERS USED IN CASTHY CALCULATION WERE AS
  FOLLOWS.

              DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
         ----------------------  ------------  ---------------
     V  = 52.07-0.7434E         , R0 =  5.1846     , A0 =  0.492
     WS = 9.997+0.1299E         , RS =  5.9767     , AS =  0.36
     WSO= 10.99                 , RSO=  6.2267     , ASO=  0.65

  THE LEVEL SCHEME WAS ADOPTED FROM ENSDF FILE/4/.
           NO.      ENERGY(MEV)    SPIN-PARITY      BETA 2/3
           GR.       0.0000          0  +
            1        0.5629          2  +            0.16
            2        1.1084          2  +            0.12
            3        1.4101          4  +
            4        1.5395          3  +
            5        1.9111          0  +
            6        2.0199          4  +
            7        2.2059          1  +
            8        2.2842          3  -            0.11
            9        2.4781          1  +
           10        2.5036          2  +            0.11
           11        2.5911          1  +
           12        2.6545          4  +
           13        2.6911          3  -
           14        2.7340          4  +
           15        2.7478          4  +
           16        2.7688          2  +
           17        2.8416          2  +
           18        2.8977          0  +
           19        2.9198          1  -
           20        3.0087          1  +
           21        3.0405          2  +            0.11
           22        3.0530          1  +
           23        3.5000          2  +            0.10(DUMMY)
           24        4.0000          2  +            0.10(DUMMY)
      LEVELS ABOVE 3.06 MEV WERE ASSUMED TO BE OVERLAPPING.

  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GIRBERT-
  CAMERON WERE EVALUATED.
  SPIN CUT-OFF PARAMETER C1 WAS TAKEN AS 0.146.

                                   GE- 76      GE- 77
                                  --------    --------
         A (MEV)                   14.230      14.200
         SPIN CUT-OFF PARAM.        9.882       9.871
         PAIRING ENERGY (MEV)       2.830       1.360
         NORMALIZATION FACTOR     2047.70     2043.40
         E-JOINT (MEV)              8.586       6.872

  THE CAPTURE CROSS SECTION WERE NORMALIZED TO 18 MILLI-
  BARNS AT 25 KEV/5/.
  ABOVE 1 MEV, DIRECT/SEMIDIRECT CAPTURE CROSS SECTION NORMALIZED
  TO 0.766MB AT 14 MEV,WERE ADDED TO CASTHGYS RESULT/6/.
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```
  MT=16,17,22,28,103,104,105,107
     (N,2N),(N,3N),(N,NA),(N,NP),(N,P),(N,D),(N,T),(N,A)
  WERE EVALUATED WITH MODIFIED EGNASH-2/7/ USING F2=1.2 AND
  FOLLOWING OPTICAL POTENTIAL
     NEUTRON    :SAME AS USED IN CASTHY
     PROTON     :PEREYS OMP/8/
     DEUTRON    :LOHR-HAEBERLIS OMP/9/
     TRITON     :BECCHETTI-GREENLESS OMP/10/
     HE-3       :BECCHETTI-GREENLESS OMP/10/
     ALPHA      :LEMOS OMP/11/
  AND NORMALIZED TO FOLLOWING DATA.
     (N,2N)     1130    MB      EXP. DATA /12,13,14,15/
     (N,P)       2.9    MB      EXP. DATA /16/
     (N,D)       1.7    MB      SYSTEMATICS/17/
     (N,A)       1.63   MB      SYSTEMATICS

  THE MU-BAR(MT=251) WAS ALSO CALCULATED WITH CASTHY.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,16,17,22,28,51-74,91
  ELASTIC AND INELASTIC SCATTERING CROSS SECTION,(N,2N),(N,3N),
  (N,NA) AND (N,NP)
  ANGULAR DISTRIBUTIONS WERE CALCULATED WITH CASTHY FOR ELA-
  STICALLY AND INELASTICALLY SCATTERED NEUTRONS.  THE DIRECT
  INELASTIC SCATTERING CONTRIBUTION WERE EVALUATED WITH
  DWUCKY PROGRAMM/18/. DEFORMATION PARAMETERS USED IN DWUCKY
  CALCUALTION WERE EVALUATED FROM COMPILATIONS/19,20/ AND
  ENSDF HALF LIFE DATA AND ADJUSTED TO REPRODUCE DDX DATA/21/.
  AS FOR (N,2N),(N,3N),(N,NA) AND (N,NP),ISOTROPIC DISTRIBUTIONS
  WERE ASSUMED.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,22,28,91
  FOR (N,2N),(N,3N),(N,NA).(N,NP) AND CONTINUM INELASTIC SCATTER-
  ING, SECONDARY NEUTRON ENERGY DISTRIBUTIONS WERE CALCULATED
  WITH EGNASH-2.
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REFERENCES
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10)F.D.BECCHETTI  AND        POLARIZATION PHENOMENA IN NUCLEAR
     G.W.GREENLESS           REACTION   682(1971) UNIV. WISCONSIN
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18)N.YAMAMURO                JAERI-M 88-140(1988)
19)S.RAMAN ET AL.            AND 42,1(1989)
20)R.H.SPEAR                 AND 42,55(1989)
21)A.TAKAHASHI ET.AL.        OKTAVIAN DATA PRIVATE COM.
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MAT number = 3325

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 33-AS- 75 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-SEP90 REV2-FEB94
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/
94-02 JENDL-3.2
       JENDL-3.1 WAS REPLACED WITH JENDL FUSION FILE
      COMPILED BY T.NAKAGAWA

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      ALL CROSS SECTIONS EXCEPT (3,102).
          (3,32), (3,33), (3,105) AND (3,106) WERE DELETED.
      ALL ANGULAR DISTRIBUTIONS EXCEPT FOR (4,2).
      ALL ENERGY DISTRIBUTIONS.
     ***********************************************************
     -------------------------------------------------------------
      JENDL FUSION FILE /2/  (AS OF FEB. 1994)
            EVALUATED BY K.KOSAKO (NEDAC) AND S. CHIBA (NDC/JAERI)
            COMPILED  BY K.KOSAKO.

      -  THE INELASTIC SCATTERING CROSS SECTIONS AND ANGULAR
         DISTRIBUTIONS OF INELASTICALLY SCATTERED NEUTRONS (EXCEPT
         CONTINUUM INELASTIC) WERE CALCULATED WITH CASTHY2Y AND
         DWUCKY IN SINCROS-II SYSTEM/3/.
      -  THE (N,2N), (N,3N), (N,NA), (N,NP), (N,P), (N,D) AND
         (N,A) REACTION CROSS SECTIONS (MT=16, 17, 22, 28, 103,
         104, 107) WERE CALCULATED BY EGNASH2 IN THE SINCROS-II.
      -  THE CAPTURE CROSS SECTION, RESONANCE PARAMETERS AND ANG.
         DISTRIBUTIONS OF ELASTICALLY SCATTERED NEUTRONS WERE
         TAKEN FROM JENDL-3.1.
      -  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCU-
         LATED BY EGNASH2.  THE DDX'S OF THE CONTINUUM NEUTRONS
         WERE OBTAINED FROM KUMABE'S SYSTEMATICS /4/ USING
         F15TOB/2/.  THE PRECOMPOUND TO COMPOUND RATIO WAS
         CALCULATED BY THE SINCROS- II CODE SYSTEM.
      -  OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED IN
         THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./3/.
         LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/5/.
     -------------------------------------------------------------


MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS (SAME AS JENDL-3.1)
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 9.7 KEV
    RESONANCE PARAMETERS FOR THE 39 LEVELS FROM 47.0 TO 2616 EV
    WERE EVALUATED ON THE BASIS OF THE DATA GIVEN BY MUGHABGHAB ET
    AL./6/  RESONANCE ENERGIES FOR THE 210 LEVELS FROM 2676 TO
    11960 EV WERE BASED ON THE MEASUREMENT BY MACKLIN/7/.  NEUTRON
    AND RADIATION WIDTHS FOR THE 210 LEVELS WERE DETERMINED BY
    DIFFERENT METHODS ACCORDING TO THE FOLLOWING THREE CONDITIONS,
    RESPECTIVELY.

    1) IN CASES WHERE TOTAL WIDTH AND NEUTRON CAPTURE AREA
    MEASURED BY MACKLIN ARE GIVEN FOR A RESONANCE LEVEL, THE
    NEUTRON AND RADIATION WIDTHS WERE SIMULTANEOUSLY OBTAINED BY
    SOLVING A QUADRATIC EQUATION.

    2) IN CASES WHERE NEUTRON CAPTURE AREA MEASURED BY MACKLIN AND
    2G*(NEUTRON WIDTH) GIVEN BY MUGHABGHAB ET AL. ARE AVAILABLE
    FOR A RESONANCE LEVEL, THE RADIATION WIDTHS WERE DERIVED FROM
    THE BOTH DATA.

    3) IN CASES WHERE ONLY NEUTRON CAPTURE AREA BY MACKLIN IS
    AVAILABLE, OR G*(NEUTRON WIDTH) BY MUGHABGHAB ET AL. IS
    SMALLER THAN NEUTRON CAPTURE AREA BY MACKLIN FOR A RESONANCE
    LEVEL, THE AVERAGE RADIATION WIDTH OF 318 MEV GIVEN BY MACKLIN
    WAS ADOPTED FOR THE LEVEL.  THE NEUTRON WIDTH WAS DERIVED FROM
    THIS AVERAGE RADIATION WIDTH AND THE NEUTRON CAPTURE AREA.

    NEUTRON ORBITAL ANGULAR MOMENTUM L OF SOME RESONANCES WAS
    ESTIMATED WITH A METHOD OF BOLLINGER AND THOMAS/8/.  TOTAL
    SPIN J OF SOME RESONANCES WAS TENTATIVELY ESTIMATED WITH A
    RANDOM NUMBER METHOD.  SCATTERING RADIUS WAS TAKEN FROM
    MUGHABGHAB ET AL.  TWO NEGATIVE RESONANCES WERE ADDED SO AS TO
    REPRODUCE THE THERMAL CAPTURE AND SCATTERING CROSS SECTIONS
    GIVEN BY MUGHABGHAB ET AL.

  UNRESOLVED RESONANCE REGION : 9.7 KEV - 100 KEV
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    THE NEUTRON STRENGTH FUNCTION S0 WAS BASED ON THE COMPILATION
    OF MUGHABGHAB ET AL., AND S1 WAS BASED ON THE SYSTEMATICS OF
    MUGHABGHAB ET AL., AND S2 WAS CALCULATED WITH OPTICAL MODEL
    CODE CASTHY/9/.  THE RADIATION WIDTH GG WAS BASED ON THE
    COMPILATION OF MUGHABGHAB ET AL.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 1.700E-4, S1 = 1.100E-4, S2 = 0.773E-4, SG = 43.3E-4,
    GG = 0.300 EV, R  = 7.248 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                       2200 M/S               RES. INTEG.
      TOTAL             9.930                    -
      ELASTIC           5.430                    -
      CAPTURE           4.500                   63.9

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.

  FOR JENDL-3.1, ABOVE 100 KEV, THE SPHERICAL OPTICAL AND
  STATISTICAL MODEL CALCULATION WAS PERFORMED WITH CASTHY, BY
  TAKING ACCOUNT OF COMPETING REACTIONS, OF WHICH CROSS SECTIONS
  WERE CALCULATED WITH PEGASUS/10/ STANDING ON A PREEQUILIBRIUM
  AND MULTI-STEP EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN
  IN TABLE 1 WERE DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF
  THE TOTAL CROSS SECTION BY CHANGING R0, RS AND RSO OF
  IIJIMA-KAWAI POTENTIAL/11/.  THE OMP'S FOR CHARGED PARTICLES ARE
  AS FOLLOWS:
     PROTON   = PEREY/12/
     ALPHA    = HUIZENGA AND IGO/13/
     DEUTERON = LOHR AND HAEBERLI/14/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/15/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/16/ WERE EVALUATED BY IIJIMA ET AL./17/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /18/.

  FOR JENDL-3.2, ALL CROSS SECTION DATA EXCEPT FOR THE ELASTIC
  SCATTERING AND CAPTURE WERE ADOPTED FROM JENDL FUSION FILE.  THE
  CALCULATION WAS MADE WITH SINCROS-II SYSTEM/3/ BY ADOPTING
  WALTER-GUSS OMP MODIFIED BY YAMAMURO/3/ FOR NEUTRON, PEREY OMP
  /19/ FOR PROTON, LEMOS OMP MODIFIED BY ARTHUR AND YOUNG/20/ FOR
  ALPHA, LOHR-HAEBERLI OMP/21/ FOR DEUTERON, BECCHETTII-GREENLEES
  OMP/22/ FOR TRITON AND HE-3, AND STANDARD LEVEL DENSITY
  PARAMETERS OF SINCROS-II SYSTEM.

  MT = 1  TOTAL
    TAKEN FROM JENDL FUSIO FILE.  SPHERICAL OPTICAL MODEL CALCULA-
    ON WITH CASTHY AND MODIFIED WALTER-GUSS POTENTIAL WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    TAKEN FROM JENDL FUSION FILE.  THE LEVEL SCHEME WAS BASED ON
    REF./5/  CONTRIBUTIONS OF THE DIRECT PROCESS WERE CALCULATED
    FOR THE LEVELS MARKED WITH '*'.

           NO.      ENERGY(MEV)    SPIN-PARITY (DIRECT PROCESS)
           GR.       0.0            3/2 -
            1        0.1986         1/2 -           *
            2        0.2647         3/2 -           *
            3        0.2795         5/2 -           *
            4        0.3039         9/2 +           *
            5        0.4007         5/2 +           *
            6        0.4686         1/2 -           *
            7        0.5722         5/2 -           *
            8        0.5850         1/2 -
            9        0.6177         1/2 -           *
           10        0.8216         7/2 -           *
      LEVELS ABOVE 0.823 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE (SAME AS JENDL-3.1)
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
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SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/23/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (3.84E-03) WAS ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION OF 350 MILLI-BARNS AT 50 KEV MEASURED BY MACKLIN/7/.

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  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
   ADOPTED FROM JENDL FUSION FILE.  THEORETICAL CALCULATION WAS
   MADE WITH SINCROS-II.  THE RESULTS WERE NORMALIZED TO

   (N,2N)      0.804-0.991 B IN 13.34-14.93 MEV BY KONNO+/24/,
   (N,D)+(N,NP) 0.0111 B AT 14.5 MEV (SYSTEMATICS OF FORREST/25/),
   (N,P)      0.0198-0.0172B IN 13.33-14.92 MEV BY KONNO+/24/,
   (N,A)           0.01007 B AT 13.98 MEV       BY KONNO+/24/.

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=2 (SAME AS JENDL-3.1)
   CALCULATED WITH THE CASTHY CODE/9/.
 MT=16, 17, 22, 28, 51-91
   TAKEN FROM JENDL FUSION FILE.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=16, 17, 22, 28, 91
   TAKEN FROM JENDL FUSION FILE.
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<< THE PARAMETERS USED IN THE CASTHY AND PEGASUS CALCULATIONS. >>

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

	DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
	V = 46.0-0.25E	R0 = 5.7	A0 = 0.62
	WS = 7.0	RS = 6.2	AS = 0.35
	VSO= 7.0	RSO= 5.7	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
31-GA- 71	*	1.332E+01	9.155E-01	1.399E+01	9.613E+00	1.430E+00
31-GA- 72	*	1.390E+01	9.028E-01	9.003E+01	8.399E+00	0.0
31-GA- 73		1.269E+01	8.264E-01	1.933E+00	7.808E+00	1.880E+00
31-GA- 74	*	1.350E+01	8.784E-01	5.236E+01	7.551E+00	0.0
32-GE- 72	*	1.350E+01	9.028E-01	3.062E+00	1.086E+01	2.790E+00
32-GE- 73	*	1.409E+01	8.904E-01	1.973E+01	9.644E+00	1.360E+00
32-GE- 74	*	1.384E+01	8.784E-01	1.667E+00	1.106E+01	3.240E+00
32-GE- 75	*	1.368E+01	8.667E-01	1.100E+01	8.810E+00	1.360E+00
33-AS- 73	*	1.369E+01	8.904E-01	1.364E+01	9.389E+00	1.430E+00
33-AS- 74		1.132E+01	9.475E-01	1.967E+01	7.033E+00	0.0
33-AS- 75		1.250E+01	9.510E-01	6.830E+00	1.008E+01	1.880E+00
33-AS- 76		1.330E+01	7.860E-01	1.900E+01	5.611E+00	0.0

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 3.5 FOR AS- 75 AND 5.0 FOR AS- 76.

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MAT number = 3425

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 34-SE- 74 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 2.6 KEV
    RESONANCE PARAMETERS WERE BASED ON MUGHABGHAB ET AL./2/
    AVERAGE RADIATION WIDTH OF 250 MEV WAS OBTAINED BY TAKING THE
    WEIGHTED AVERAGE OF RADIATION WIDTHS FOR SIX RESONANCE LEVELS,
    AND WAS ADOPTED FOR THE LEVELS OF 1.630 AND 7.216 KEV WHOSE
    RADIATION WIDTH WAS UNKNOWN.  SCATTERING RADIUS WAS ALSO TAKEN
    FROM MUGHABGHAB ET AL.  A NEGATIVE RESONANCE WAS ADDED SO AS
    TO REPRODUCE THE CAPTURE CROSS SECTION OF 51.8+-1.2 BARNS AT
    0.0253 EV GIVEN BY MUGHABGHAB ET AL.

  UNRESOLVED RESONANCE REGION : 2.6 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTION S0 WAS BASED ON THE COMPILATION
    OF MUGHABGHAB ET AL., AND S1 WAS BASED ON THE SYSTEMATICS OF
    MHGHABGHAB ET AL., S2 WAS CALCULATED WITH OPTICAL MODEL CODE
    CASTHY/3/.  THE OBSERVED LEVEL SPACING WAS DETERMINED TO
    REPRODUCE THE CAPTURE CROSS SECTION CALCULATED WITH CASTHY.
    THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED FROM FITTING TO
    THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.  THE RADIATION
    WIDTH GG WAS BASED ON THE COMPILATION OF MUGHABGHAB ET AL.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 1.290E-4, S1 = 1.000E-4, S2 = 0.780E-4, SG = 5.68E-4,
    GG = 0.280 EV, R  = 7.514 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL          59.07                    -
      ELASTIC         7.274                   -
      CAPTURE        51.80                  580

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/4/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING RO, RS AND RSO OF IIJIMA-KAWAI POTENTIAL/5/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/6/
     ALPHA    = HUIZENGA AND IGO/7/
     DEUTERON = LOHR AND HAEBERLI/8/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/9/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/10/ WERE EVALUATED BY IIJIMA ET AL./11/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /12/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/13/ AND NUCLEAR DATA
    SHEETS/14/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             0  +
            1        0.6348          2  +
            2        0.8538          0  +
            3        1.2689          2  +
            4        1.3632          4  +
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            5         1.6000          2  +
      LEVELS ABOVE 1.658 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/15/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (4.30E-04) WAS ADJUSTED TO
    REPRODUCE THE CAPTURE CROSS SECTION OF 198 MILLI-BARNS AT 25
    KEV MEASURED BY SRIRAMACHANDRA ET AL./16/

  MT = 16  (N,2N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =106  (N,HE3) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
  MT =111  (N,2P) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (=  69.8) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/17/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,P)         135.00  MB (RECOMMENDED BY FORREST/18/)
      (N,ALPHA)      34.80  MB (SYSTEMATICS OF FORREST/18/)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                 DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
         ----------------------    -----------   ---------------
         V  = 46.0-0.25E           R0 = 5.7      A0 = 0.62
         WS = 7.0                  RS = 6.2      AS = 0.35
         VSO= 7.0                  RSO= 5.7      ASO= 0.62
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2  LEVEL DENSITY PARAMETERS

 NUCLIDE  SYST A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
 ---------------------------------------------------------------
 32-GE- 70  *  1.236E+01 9.286E-01 1.710E+00 1.048E+01 2.860E+00
 32-GE- 71  *  1.293E+01 9.155E-01 1.132E+01 9.208E+00 1.360E+00
 32-GE- 72  *  1.350E+01 9.028E-01 3.062E+00 1.086E+01 2.790E+00
 32-GE- 73  *  1.409E+01 8.904E-01 1.973E+01 9.644E+00 1.360E+00

 33-AS- 71  *  1.254E+01 9.155E-01 7.299E+00 9.012E+00 1.500E+00
 33-AS- 72  *  1.311E+01 9.028E-01 5.047E+01 7.739E+00 0.0
 33-AS- 73  *  1.369E+01 8.904E-01 1.364E+01 9.389E+00 1.430E+00
 33-AS- 74     1.132E+01 9.475E-01 1.967E+01 7.033E+00 0.0

 34-SE- 72  *  1.272E+01 9.028E-01 1.477E+00 1.034E+01 2.930E+00
 34-SE- 73     1.404E+01 8.250E-01 7.927E+00 8.288E+00 1.430E+00
 34-SE- 74     1.290E+01 8.620E-01 1.070E+00 9.612E+00 2.860E+00
 34-SE- 75     1.391E+01 8.500E-01 9.741E+00 8.707E+00 1.430E+00
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  SYST:  * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

 SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
 IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
 ASSUMED TO BE 3.925 FOR SE- 74 AND 5.0 FOR SE- 75.
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MAT number = 3431

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 34-SE- 76 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 9 KEV
    RESONANCE PARAMETERS WERE BASED ON MUGHABGHAB ET AL./2/
    AVERAGE RADIATION WIDTH GIVEN BY MUGHABGHAB ET AL. WAS
    SLIGHTLY MODIFIED AND WAS ADOPTED FOR THE 16 RESONANCE LEVELS
    WHOSE RADIATION WIDTH WAS UNKNOWN.  NEUTRON ORBITAL ANGULAR
    MOMENTUM L OF SOME RESONANCES WAS ESTIMATED WITH A METHOD OF
    BOLLINGER AND THOMAS/3/.  SCATTERING RADIUS WAS ALSO TAKEN
    FROM MUGHABGHAB ET AL.  A NEGATIVE RESONANCE WAS ADDED SO AS
    TO REPRODUCE THE THERMAL CAPTURE AND SCATTERING CROSS SECTIONS
    GIVEN BY MUGHABGHAB ET AL.

  UNRESOLVED RESONANCE REGION : 9 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0 AND S1 WERE BASED ON THE
    COMPILATION OF MUGHABGHAB ET AL., AND S2 WAS CALCULATED WITH
    OPTICAL MODEL CODE CASTHY/4/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH GG WAS BASED ON THE COMPILATION OF
    MUGHABGHAB ET AL.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 1.640E-4, S1 = 0.939E-4, S2 = 0.760E-4, SG = 1.90E-4,
    GG = 0.230 EV, R  = 7.363 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                        2200 M/S               RES. INTEG.
      TOTAL           103.4                     -
      ELASTIC          18.40                    -
      CAPTURE          85.00                   41.1

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/5/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING RO, RS AND RSO OF IIJIMA-KAWAI POTENTIAL/6/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/7/
     ALPHA    = HUIZENGA AND IGO/8/
     DEUTERON = LOHR AND HAEBERLI/9/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/10/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/11/ WERE EVALUATED BY IIJIMA ET AL./12/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /13/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/14/ AND NUCLEAR DATA
    SHEETS/15/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             0  +
            1        0.5591          2  +
            2        1.1223          0  +
            3        1.2161          2  +
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                 4          1.3309          4   +
                 5          1.6890          3   +
                 6          1.7876          2   +
                 7          2.0260          4   +
                 8          2.1272          2   +
                 9          2.1705          0   +
                10          2.2623          6   +
                11          2.3629          2   +
                12          2.4291          3   -
                13          2.4886          5   +
                14          2.5147          2   +
                15          2.5700          4   +
                16          2.6057          4   +
                17          2.6184          4   +
                18          2.6309          1   -
                19          2.6553          1   -
                20          2.6699          2   -
                21          2.8045          2   +
                22          2.8125          4   +
                23          2.8167          2   +
                24          2.8248          5   -
                25          2.8597          4   -
                26          2.8698          4   +
                27          2.9110          4   -
                28          2.9200          4   +
                29          2.9506          1   +
      LEVELS ABOVE 2.968 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/16/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (1.59E-04) WAS ASSUMED.

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =106  (N,HE3) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
  MT =111  (N,2P) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (=  68.3) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/17/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,2N) (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,2N)       900.00  MB (RECOMMENDED BY BYCHKOV+/18/)
      (N,P)         70.00  MB (RECOMMENDED BY FORREST/19/)
      (N,ALPHA)     15.60  MB (SYSTEMATICS OF FORREST/19/)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
           ----------------------  ------------  ---------------
          V  = 46.0-0.25E          R0 = 5.7      A0 = 0.62
          WS = 7.0                 RS = 6.2      AS = 0.35
          VSO= 7.0                 RSO= 5.7      ASO= 0.62
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.
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TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
32-GE- 72	*	1.350E+01	9.028E-01	3.062E+00	1.086E+01	2.790E+00
32-GE- 73	*	1.409E+01	8.904E-01	1.973E+01	9.644E+00	1.360E+00
32-GE- 74	*	1.384E+01	8.784E-01	1.667E+00	1.106E+01	3.240E+00
32-GE- 75	*	1.368E+01	8.667E-01	1.100E+01	8.810E+00	1.360E+00
33-AS- 73	*	1.369E+01	8.904E-01	1.364E+01	9.389E+00	1.430E+00
33-AS- 74		1.132E+01	9.475E-01	1.967E+01	7.033E+00	0.0
33-AS- 75		1.250E+01	9.510E-01	6.830E+00	1.008E+01	1.880E+00
33-AS- 76		1.330E+01	7.860E-01	1.900E+01	5.611E+00	0.0
34-SE- 74		1.290E+01	8.620E-01	1.070E+00	9.612E+00	2.860E+00
34-SE- 75		1.391E+01	8.500E-01	9.741E+00	8.707E+00	1.430E+00
34-SE- 76		1.315E+01	8.900E-01	1.097E+00	1.082E+01	3.310E+00
34-SE- 77		1.438E+01	8.000E-01	7.140E+00	8.015E+00	1.430E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 6.780 FOR SE- 76 AND 6.517 FOR SE- 77.

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MAT number = 3434

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 34-SE- 77 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 2.7 KEV
    RESONANCE PARAMETERS WERE BASED ON MUGHABGHAB ET AL./2/ TOTAL
    SPIN J OF SOME RESONANCES WAS TENTATIVELY ESTIMATED WITH A
    RANDOM NUMBER METHOD.  NEUTRON ORBITAL ANGULAR MOMENTUM L OF
    SOME RESONANCES WAS ESTIMATED WITH A METHOD OF BOLLINGER AND
    THOMAS/3/.  AVERAGE RADIATION WIDTH OF 380 MEV WAS OBTAINED BY
    TAKING THE WEIGHTED AVERAGE OF RADIATION WIDTHS FOR 17
    RESONANCE LEVELS, AND WAS ADOPTED FOR THE LEVELS WHOSE
    RADIATION WIDTH WAS UNKNOWN.  SCATTERING RADIUS WAS ALSO TAKEN
    FROM MUGHABGHAB ET AL.  A NEGATIVE RESONANCE WAS ADDED SO AS
    TO REPRODUCE THE THERMAL CAPTURE AND SCATTERING CROSS SECTIONS
    GIVEN BY MUGHABGHAB ET AL.

  UNRESOLVED RESONANCE REGION : 2.7 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0 AND S1 WERE BASED ON THE
    COMPILATION OF MUGHABGHAB ET AL., AND S2 WAS CALCULATED WITH
    OPTICAL MODEL CODE CASTHY/4/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH GG WAS BASED ON THE COMPILATION OF
    MUGHABGHAB ET AL.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 1.280E-4, S1 = 0.760E-4, S2 = 0.740E-4, SG = 43.8E-4,
    GG = 0.390 EV, R  = 7.608 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL         50.43                     -
      ELASTIC        8.430                    -
      CAPTURE       42.00                   32.1

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/5/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING RO, RS AND RSO OF IIJIMA-KAWAI POTENTIAL/6/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/7/
     ALPHA    = HUIZENGA AND IGO/8/
     DEUTERON = LOHR AND HAEBERLI/9/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/10/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/11/ WERE EVALUATED BY IIJIMA ET AL./12/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /13/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/14/ AND NUCLEAR DATA
    SHEETS/15/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0            1/2 -
            1        0.1620         7/2 +
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2	0.1755	9/2 +
3	0.2390	3/2 -
4	0.2497	5/2 -
5	0.3011	5/2 +
6	0.4395	5/2 -
7	0.5206	3/2 -
8	0.5809	7/2 -
9	0.6800	5/2 +
10	0.7959	7/2 +
11	0.8084	7/2 -
12	0.8178	1/2 -
13	0.8244	3/2 -
14	0.9115	3/2 +
15	0.9470	1/2 +
16	0.9699	11/2 +
17	0.9778	9/2 -
18	1.0051	3/2 -
19	1.0242	13/2 +
20	1.1284	1/2 +
21	1.1321	3/2 -
22	1.1725	9/2 -
23	1.1793	3/2 +
24	1.1868	3/2 -
25	1.1929	7/2 -
26	1.2306	5/2 -
27	1.2526	5/2 +
28	1.3513	11/2 -

LEVELS ABOVE 1.367 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/16/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (2.65E-03) WAS DETERMINED FROM THE RADIATION WIDTH (0.39 EV) AND AVERAGE S-WAVE RESONANCE LEVEL SPACING (147+-30 EV) /2/.

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT = 32 (N,N'D) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =106 (N,HE3) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
MT =111 (N,2P) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 99.1) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/17/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,P)	35.00 MB	(RECOMMENDED BY FORREST/18/)
(N,ALPHA)	10.10 MB	(SYSTEMATICS OF FORREST/18/)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 46.0-0.25E	R0 = 5.7	A0 = 0.62

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      WS = 7.0                          RS = 6.2      AS = 0.35
      VSO= 7.0                          RSO= 5.7      ASO= 0.62
 THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.
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TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
32-GE- 73	*	1.409E+01	8.904E-01	1.973E+01	9.644E+00	1.360E+00
32-GE- 74	*	1.384E+01	8.784E-01	1.667E+00	1.106E+01	3.240E+00
32-GE- 75	*	1.368E+01	8.667E-01	1.100E+01	8.810E+00	1.360E+00
32-GE- 76	*	1.352E+01	8.553E-01	1.533E+00	9.919E+00	2.830E+00
33-AS- 74		1.132E+01	9.475E-01	1.967E+01	7.033E+00	0.0
33-AS- 75		1.250E+01	9.510E-01	6.830E+00	1.008E+01	1.880E+00
33-AS- 76		1.330E+01	7.860E-01	1.900E+01	5.611E+00	0.0
33-AS- 77		1.300E+01	8.440E-01	4.637E+00	7.951E+00	1.470E+00
34-SE- 75		1.391E+01	8.500E-01	9.741E+00	8.707E+00	1.430E+00
34-SE- 76		1.315E+01	8.900E-01	1.097E+00	1.082E+01	3.310E+00
34-SE- 77		1.438E+01	8.000E-01	7.140E+00	8.015E+00	1.430E+00
34-SE- 78		1.287E+01	8.750E-01	1.163E+00	9.882E+00	2.900E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 6.517 FOR SE- 77 AND 4.875 FOR SE- 78.

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MAT number = 3437

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 34-SE- 78 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 12 KEV
    RESONANCE PARAMETERS WERE BASED ON MUGHABGHAB ET AL./2/
    NEUTRON ORBITAL ANGULAR MOMENTUM L OF SOME RESONANCES WAS
    ESTIMATED WITH A METHOD OF BOLLINGER AND THOMAS/3/.  AVERAGE
    RADIATION WIDTH WAS OBTAINED BY TAKING THE WEIGHTED AVERAGE OF
    RADIATION WIDTHS FOR FOUR RESONANCE LEVELS, AND WAS ADOPTED
    FOR THE 16 LEVELS WHOSE RADIATION WIDTH WAS UNKNOWN.  SCATTE-
    RING RADIUS WAS ALSO TAKEN FROM MUGHABGHAB ET AL.  A NEGATIVE
    RESONANCE WAS ADDED SO AS TO REPRODUCE THE THERMAL CAPTURE AND
    SCATTERING CROSS SECTIONS GIVEN BY MUGHABGHAB ET AL.

  UNRESOLVED RESONANCE REGION : 12 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0 AND S1 WERE BASED ON THE
    COMPILATION OF MUGHABGHAB ET AL., AND S2 WAS CALCULATED WITH
    OPTICAL MODEL CODE CASTHY/4/.  THE OBSERVED LEVEL SPACING WERE
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH GG WAS BASED ON THE COMPILATION OF
    MUGHABGHAB ET AL.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 1.230E-4, S1 = 1.730E-4, S2 = 0.730E-4, SG = 1.82E-4,
    GG = 0.230 EV, R  = 7.274 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           8.830                   -
      ELASTIC         8.400                   -
      CAPTURE         0.4300                   4.74

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY/4/, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/5/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING RO, RS AND RSO OF IIJIMA-KAWAI POTENTIAL/6/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/7/
     ALPHA    = HUIZENGA AND IGO/8/
     DEUTERON = LOHR AND HAEBERLI/9/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/10/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/11/ WERE EVALUATED BY IIJIMA ET AL./12/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /13/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/14/ AND NUCLEAR DATA
    SHEETS/15/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0              0  +
            1        0.6138           2  +
            2        1.3086           2  +
            3        1.4986           0  +
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             4         1.5026          4  +
             5         1.7587          0  +
             6         1.8540          2  +
             7         1.9960          2  +
             8         2.0983          4  +
             9         2.2673          4  +
            10         2.2998          1  +
            11         2.3273          2  +
            12         2.3347          0  +
            13         2.3602          4  +
            14         2.5076          3  -
            15         2.5374          0  +
            16         2.5387          6  +
            17         2.6476          0  +
            18         2.6801          1  +
            19         2.6821          1  -
            20         2.7192          4  +
       LEVELS ABOVE 2.748 MEV WERE ASSUMED TO BE OVERLAPPING.

   MT = 102  CAPTURE
     SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
     CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
     SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
     AND REFFO/16/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

     THE GAMMA-RAY STRENGTH FUNCTION (1.655E-04) WAS DETERMINED
     FROM THE RADIATION WIDTH (0.23 EV) AND AVERAGE S-WAVE
     RESONANCE LEVEL SPACING (1390+-500 EV)/2/.

   MT = 16  (N,2N) CROSS SECTION
   MT = 17  (N,3N) CROSS SECTION
   MT = 22  (N,N'A) CROSS SECTION
   MT = 28  (N,N'P) CROSS SECTION
   MT =103  (N,P) CROSS SECTION
   MT =104  (N,D) CROSS SECTION
   MT =105  (N,T) CROSS SECTION
   MT =107  (N,ALPHA) CROSS SECTION
     THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
     PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

     THE KALBACH'S CONSTANT K (=  78.0) WAS ESTIMATED BY THE
     FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/17/ AND LEVEL
     DENSITY PARAMETERS.

     FINALLY, THE (N,2N), (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
     NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
       (N,2N)      1050.00  MB (RECOMMENDED BY BYCHKOV+/18/)
       (N,P)         18.00  MB (RECOMMENDED BY FORREST/19/)
       (N,ALPHA)      5.50  MB (RECOMMENDED BY FORREST)

   MT = 251  MU-BAR
     CALCULATED WITH CASTHY.

 MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
   LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
   GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
   TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
   CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
   BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

 MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
   ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
   PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
   OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
          ----------------------  ------------  ---------------
        V  = 46.0-0.25E           R0 = 5.7      A0 = 0.62
        WS = 7.0                  RS = 6.2      AS = 0.35
        VSO= 7.0                  RSO= 5.7      ASO= 0.62
   THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2  LEVEL DENSITY PARAMETERS

 NUCLIDE   SYST  A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
 ---------------------------------------------------------------
 32-GE- 74  *  1.384E+01 8.784E-01 1.667E+00 1.106E+01 3.240E+00
 32-GE- 75  *  1.368E+01 8.667E-01 1.100E+01 8.810E+00 1.360E+00
 32-GE- 76  *  1.352E+01 8.553E-01 1.533E+00 9.919E+00 2.830E+00
 32-GE- 77  *  1.334E+01 8.442E-01 6.660E+00 8.098E+00 1.360E+00
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33-AS- 75	1.250E+01	9.510E-01	6.830E+00	1.008E+01	1.880E+00
33-AS- 76	1.330E+01	7.860E-01	1.900E+01	5.611E+00	0.0
33-AS- 77	1.300E+01	8.440E-01	4.637E+00	7.951E+00	1.470E+00
33-AS- 78	1.150E+01	7.500E-01	5.001E+00	3.894E+00	0.0
34-SE- 76	1.315E+01	8.900E-01	1.097E+00	1.082E+01	3.310E+00
34-SE- 77	1.438E+01	8.000E-01	7.140E+00	8.015E+00	1.430E+00
34-SE- 78	1.287E+01	8.750E-01	1.163E+00	9.882E+00	2.900E+00
34-SE- 79	1.412E+01	8.000E-01	5.994E+00	7.842E+00	1.430E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 4.875 FOR SE- 78 AND 4.672 FOR SE- 79.

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MAT number = 3440

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 34-SE- 79 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  NO RESOLVED RESONANCE PARAMETERS

  UNRESOLVED RESONANCE REGION : 38 EV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0 AND S2 WERE CALCULATED WITH
    OPTICAL MODEL CODE CASTHY/2/, AND S1 WAS BASED ON THE
    SYSTEMATICS OF MUGHABGHAB ET AL./3/ THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.  THE RADIATION WIDTH WAS ESTIMATED FROM ITS
    SYSTEMATICS.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.580E-4, S1 = 1.700E-4, S2 = 0.720E-4, SG = 4.40E-4,
    GG = 0.290 EV, R  = 7.553 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL          56.30                    -
      ELASTIC         6.300                   -
      CAPTURE        50.00                  60.9

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 38 EV, THE CAPTURE AND ELASTIC SCATTERING CROSS SECTIONS
  WERE ASSUMED TO BE IN 1/V FORM AND CONSTANT, RESPECTIVELY.  THE
  THERMAL CAPTURE CROSS SECTION WAS DETERMINED BY THE SYSTEMATICS
  FROM THE NEIGHBORING SE ISOTOPES.  THE SCATTERING CROSS SECTION
  WAS ESTIMATED BY ASSUMING R = 7.1 FM.  UNRESOLVED RESONANCE
  PARAMETERS WERE GIVEN IN THE ENERGY RANGE FROM 38 EV TO 100 KEV.

  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/4/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING RO, RS AND RSO OF IIJIMA-KAWAI POTENTIAL/5/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/6/
     ALPHA    = HUIZENGA AND IGO/7/
     DEUTERON = LOHR AND HAEBERLI/8/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/9/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/10/ WERE EVALUATED BY IIJIMA ET AL./11/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /12/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/13/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0            7/2 +
            1        0.0957         1/2 -
            2        0.1280         1/2 -
            3        0.1370         9/2 +
            4        0.3650         5/2 -
            5        0.4990         1/2 -
            6        0.5279         3/2 -
            7        0.5720         3/2 -
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          8        0.6300         5/2 +
          9        0.7286         5/2 +
         10        0.7904         7/2 -
         11        0.8188         7/2 -
         12        0.8971         7/2 +
         13        0.9746         3/2 -
         14        0.9829         7/2 +
         15        1.0082         5/2 -
         16        1.0721        13/2 +
         17        1.0800         1/2 +
         18        1.0888         1/2 +
         19        1.1101         7/2 +
         20        1.1450         1/2 +
         21        1.2313         5/2 +
         22        1.2534         5/2 +
         23        1.2567         5/2 +
         24        1.3399         5/2 -
         25        1.3850         5/2 -
         26        1.4910         1/2 +
         27        1.5890         3/2 +
         28        1.6670         5/2 +
         29        1.7377         3/2 +
      LEVELS ABOVE 1.76 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/14/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (3.82E-03) WAS DETERMINED FROM
    THE SYSTEMATICS OF RADIATION WIDTH (0.29 EV) AND THE AVERAGE
    S-WAVE RESONANCE LEVEL SPACING (76 EV) CALCULATED FROM THE
    LEVEL DENSITY PARAMETERS.

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT = 32  (N,N'D) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =106  (N,HE3) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (=  96.0) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/15/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,P)          9.97  MB (SYSTEMATICS OF FORREST/16/)
      (N,ALPHA)      9.93  MB (SYSTEMATICS OF FORREST)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
         ----------------------   ------------  ---------------
        V  = 46.0-0.25E           R0 = 5.7      A0 = 0.62
        WS = 7.0                  RS = 6.2      AS = 0.35
        VSO= 7.0                  RSO= 5.7      ASO= 0.62
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2  LEVEL DENSITY PARAMETERS
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NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
32-GE- 75	*	1.368E+01	8.667E-01	1.100E+01	8.810E+00	1.360E+00
32-GE- 76	*	1.352E+01	8.553E-01	1.533E+00	9.919E+00	2.830E+00
32-GE- 77	*	1.334E+01	8.442E-01	6.660E+00	8.098E+00	1.360E+00
32-GE- 78		1.234E+01	8.699E-01	7.304E-01	9.395E+00	2.930E+00
33-AS- 76		1.330E+01	7.860E-01	1.900E+01	5.611E+00	0.0
33-AS- 77		1.300E+01	8.440E-01	4.637E+00	7.951E+00	1.470E+00
33-AS- 78		1.150E+01	7.500E-01	5.001E+00	3.894E+00	0.0
33-AS- 79		1.290E+01	8.230E-01	3.020E+00	7.585E+00	1.570E+00
34-SE- 77		1.438E+01	8.000E-01	7.140E+00	8.015E+00	1.430E+00
34-SE- 78		1.287E+01	8.750E-01	1.163E+00	9.882E+00	2.900E+00
34-SE- 79		1.412E+01	8.000E-01	5.994E+00	7.842E+00	1.430E+00
34-SE- 80		1.334E+01	8.130E-01	6.129E-01	9.136E+00	3.000E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 4.672 FOR SE- 79 AND 2.952 FOR SE- 80.

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MAT number = 3443

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 34-SE- 80 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-SEP90 REV2-MAR93
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/
93-03 JENDL-3.2 WAS MADE BY JNDC FPND W.G.

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)              UPPER BOUNDARY ENERGY CHANGED
     ***********************************************************


MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 10 KEV
    RESONANCE PARAMETERS WERE BASED ON MUGHABGHAB ET AL./2/
    TOTAL SPIN J OF SOME RESONANCES WAS TENTATIVELY ESTIMATED WITH
    A RANDOM NUMBER METHOD.  AVERAGE RADIATION WIDTH OF 220 MEV
    WAS OBTAINED BY TAKING THE WEIGHTED AVERAGE OF RADIATION
    WIDTHS FOR THE TWO LEVELS, AND WAS ADOPTED FOR THE 13 LEVELS
    WHOSE RADIATION WIDTH WAS UNKNOWN.  SCATTERING RADIUS WAS
    TAKEN FROM MUGHABGHAB ET AL.  A NEGATIVE RESONANCE WAS ADDED
    SO AS TO REPRODUCE THE THERMAL CAPTURE AND SCATTERING CROSS
    SECTIONS GIVEN BY MUGHABGHAB ET AL.

  UNRESOLVED RESONANCE REGION : 10 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTION S0 WAS BASED ON THE COMPILATION
    OF MUGHABGHAB ET AL., AND S1 WAS BASED ON THE SYSTEMATICS OF
    MUGHABGHAB ET AL., AND S2 WAS CALCULATED WITH OPTICAL MODEL
    CODE CASTHY/3/.  THE OBSERVED LEVEL SPACING WAS DETERMINED TO
    REPRODUCE THE CAPTURE CROSS SECTION CALCULATED WITH CASTHY.
    THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED FROM FITTING TO
    THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.  THE RADIATION
    WIDTH GG WAS BASED ON THE COMPILATION OF MUGHABGHAB ET AL.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 1.610E-4, S1 = 1.800E-4, S2 = 0.700E-4, SG = 0.488E-4,
    GG = 0.230 EV, R  = 6.989 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                    2200 M/S               RES. INTEG.
      TOTAL          7.560                    -
      ELASTIC        6.950                    -
      CAPTURE        0.6100                  0.976

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/4/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING RO, RS AND RSO OF IIJIMA-KAWAI POTENTIAL/5/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/6/
     ALPHA    = HUIZENGA AND IGO/7/
     DEUTERON = LOHR AND HAEBERLI/8/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/9/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/10/ WERE EVALUATED BY IIJIMA ET AL./11/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /12/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/13/ AND NUCLEAR DATA
    SHEETS/14/.
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            NO.      ENERGY(MEV)    SPIN-PARITY
            GR.        0.0              0  +
             1         0.6662           2  +
             2         1.4493           2  +
             3         1.4791           0  +
             4         1.7015           4  +
             5         1.8734           0  +
             6         1.9602           2  +
             7         2.1211           4  +
             8         2.3115           1  -
             9         2.3441           1  -
            10         2.4953           2  +
            11         2.5143           2  +
            12         2.6272           0  +
            13         2.7174           3  -
            14         2.7743           1  -
            15         2.8142           2  +
            16         2.8255           3  -
            17         2.8272           2  +
            18         2.8363           1  -
            19         2.9475           4  +
            20         3.0250           1  -
            21         3.0387           1  -
            22         3.1262           2  +
            23         3.1754           1  -
            24         3.1995           2  +
            25         3.2266           1  +
            26         3.2485           2  +
            27         3.2804           1  -
            28         3.3166           0  +
            29         3.3504           1  +
       LEVELS ABOVE 3.391 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/15/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (4.66E-5) WAS ADJUSTED TO
    REPRODUCE THE CAPTURE CROSS SECTION OF 16 MILLI-BARNS AT 200
    KEV MEASURED BY WALTER/16/

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (=  92.4) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/17/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,P)          16.00  MB (RECOMMENDED BY FORREST/18/)
      (N,ALPHA)      17.00  MB (RECOMMENDED BY FORREST)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY/3/.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
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   V  = 46.0-0.25E          R0 = 5.7      A0 = 0.62
   WS = 7.0                 RS = 6.2      AS = 0.35
   VSO= 7.0                 RSO= 5.7      ASO= 0.62
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THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
32-GE- 76	*	1.352E+01	8.553E-01	1.533E+00	9.919E+00	2.830E+00
32-GE- 77	*	1.334E+01	8.442E-01	6.660E+00	8.098E+00	1.360E+00
32-GE- 78		1.234E+01	8.699E-01	7.304E-01	9.395E+00	2.930E+00
32-GE- 79		1.362E+01	7.523E-01	2.737E+00	6.567E+00	1.360E+00
33-AS- 77		1.300E+01	8.440E-01	4.637E+00	7.951E+00	1.470E+00
33-AS- 78		1.150E+01	7.500E-01	5.001E+00	3.894E+00	0.0
33-AS- 79		1.290E+01	8.230E-01	3.020E+00	7.585E+00	1.570E+00
33-AS- 80		1.150E+01	7.250E-01	4.181E+00	3.535E+00	0.0
34-SE- 78		1.287E+01	8.750E-01	1.163E+00	9.882E+00	2.900E+00
34-SE- 79		1.412E+01	8.000E-01	5.994E+00	7.842E+00	1.430E+00
34-SE- 80		1.334E+01	8.130E-01	6.129E-01	9.136E+00	3.000E+00
34-SE- 81		1.368E+01	7.490E-01	2.463E+00	6.614E+00	1.430E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 2.952 FOR SE- 80 AND 5.0 FOR SE- 81.

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MAT number = 3449

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 34-SE- 82 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 18 KEV
    RESONANCE ENERGIES WERE BASED ON THE EXPERIMENTAL DATA BY
    BROWNE AND BERMAN/2/.  THE VALUES OF NEUTRON ORBITAL ANGULAR
    MOMENTUM L AND TOTAL SPIN J WERE ASSUMED TO BE 0 AND 0.5 FOR
    ALL RESONANCE LEVELS, RESPECTIVELY.

    REDUCED NEUTRON WIDTH OF EACH RESONANCE LEVEL WAS ROUGHLY
    ESTIMATED ON THE BASIS OF THE DESCRIPTION FOR RESONANCE
    STRUCTURES GIVEN BY BROWNE AND BERMAN, AND OF THE REDUCED
    NEUTRON WIDTHS GIVEN BY MUGHABGHAB ET AL./3/ IN THE FIRST
    STAGE.  NEXT, THERMAL SCATTERING CROSS SECTION WAS CALCULATED
    USING THE ROUGHLY ESTIMATED REDUCED NEUTRON WIDTHS, AND A
    NORMALIZATION FACTOR WAS OBTAINED SO AS TO REPRODUCE THE
    EXPERIMENTAL DATA OF 5.0+-0.2 BARNS GIVEN BY MUGHABGHAB ET AL.
    THE FINAL NEUTRON WIDTHS WERE DETERMINED BY USING THIS
    NORMALIZATION FACTOR AND THE RESONANCE ENERGIES GIVEN BY
    BROWNE AND BERMAN.

    SCATTERING RADIUS WAS TAKEN FROM MUGHABGHAB ET AL.  AVERAGE
    RADIATION WIDTH WAS ALSO DETERMINED SO AS TO REPRODUCE THERMAL
    CAPTURE CROSS SECTION OF 44.2 MB GIVEN BY MUGHABGHAB ET AL.  A
    NEGATIVE RESONANCE WAS ADDED AT -120 EV IN THE PRESENT
    ANALYSIS.

  UNRESOLVED RESONANCE REGION : 18 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTION S0 WAS BASED ON THE COMPILATION
    OF MUGHABGHAB ET AL., AND S1 WAS BASED ON THE SYSTEMATICS OF
    MUGHABGHAB ET AL., AND S2 WAS CALCULATED WITH OPTICAL MODEL
    CODE CASTHY/4/.  THE OBSERVED LEVEL SPACING WERE DETERMINED TO
    REPRODUCE THE CAPTURE CROSS SECTION CALCULATED WITH CASTHY.
    THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED FROM FITTING TO
    THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.  THE RADIATION
    WIDTH GG WAS DETERMINED FROM A SYSTEMATIC TREND OF MEASURED
    VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 1.210E-4, S1 = 2.100E-4, S2 = 0.680E-4, SG = 0.572E-4,
    GG = 0.190 EV, R  = 7.074 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           5.044                    -
      ELASTIC         5.000                    -
      CAPTURE         0.04420                   0.799

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/5/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING RO, RS AND RSO OF IIJIMA-KAWAI POTENTIAL/6/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/7/
     ALPHA    = HUIZENGA AND IGO/8/
     DEUTERON = LOHR AND HAEBERLI/9/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/10/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/11/ WERE EVALUATED BY IIJIMA ET AL./12/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /13/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.
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MT = 2 ELASTIC SCATTERING
CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

MT = 4, 51 - 91 INELASTIC SCATTERING
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR STRUCTURE DATA FILE (1987 VERSION)/14/ AND NUCLEAR DATA SHEETS/15/.

NO.	ENERGY(MEV)	SPIN-PARITY
GR.	0.0	0 +
1	0.6548	2 +
2	1.4200	0 +
3	1.7312	2 +
4	1.7354	4 +
5	2.5508	3 +
6	2.8942	5 -

LEVELS ABOVE 3.015 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/16/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (5.46E-05) WAS ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION OF 0.045 BARN AT 25 KEV WHICH WAS A SOMEWHAT LARGER VALUE THAN A META-STABLE STATE PRODUCTION CROSS SECTION OF 0.045 BARN AT 24 KEV MEASURED BY CHAUBEY AND SEHGAL/17/

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 96.6) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/18/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,2N) AND (N,P) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
(N,2N)   1100.00 MB (MEASURED BY FREHAUT+/19/)
(N,P)   2.40 MB (SYSTEMATICS OF FORREST/20/)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 46.0-0.25E	R0 = 5.7	A0 = 0.62
WS = 7.0	RS = 6.2	AS = 0.35
VSO= 7.0	RSO= 5.7	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
32-GE- 78		1.234E+01	8.699E-01	7.304E-01	9.395E+00	2.930E+00
32-GE- 79		1.362E+01	7.523E-01	2.737E+00	6.567E+00	1.360E+00
32-GE- 80	*	1.277E+01	8.125E-01	5.273E-01	8.551E+00	2.820E+00

32-GE- 81	*	1.255E+01	8.025E-01	2.496E+00	6.770E+00	1.360E+00
33-AS- 79		1.290E+01	8.230E-01	3.020E+00	7.585E+00	1.570E+00
33-AS- 80		1.150E+01	7.250E-01	4.181E+00	3.535E+00	0.0
33-AS- 81	*	1.293E+01	8.025E-01	2.772E+00	7.120E+00	1.460E+00
33-AS- 82	*	1.271E+01	7.927E-01	1.371E+01	5.344E+00	0.0
34-SE- 80		1.334E+01	8.130E-01	6.129E-01	9.136E+00	3.000E+00
34-SE- 81		1.368E+01	7.490E-01	2.463E+00	6.614E+00	1.430E+00
34-SE- 82		1.259E+01	7.980E-01	3.563E-01	8.246E+00	2.890E+00
34-SE- 83		1.381E+01	7.500E-01	2.666E+00	6.708E+00	1.430E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 6.291 FOR SE- 82 AND 5.0 FOR SE- 83.

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MAT number = 3525
 35-BR- 79 JNDC        EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                       DIST-SEP90 REV2-MAR93
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/
93-03 JENDL-3.2 WAS MADE BY JNDC FPND W.G.

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)       UNRESOLVED RESONANCE PARAMETERS RE-ADJUSTED
                    SO AS TO REPRODUCE THE RE-NORMALIZED CAPTURE
                    CROSS SECTION.
      (3,102)       RE-NORMALIZED.
      (3,4), (3,51-91) AND ANGULAR DISTRIBUTIONS
                    SMALL EFFECTS OF THE RE-NORMALIZATION OF THE
                    CAPTURE CROSS SECTION.
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MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 5.5 KEV
    RESONANCE ENERGIES FOR THE 333 LEVELS AND FOR THE REMAINING
    8 LEVELS WERE BASED ON THE MEASUREMENTS BY MACKLIN/2/ AND BY
    OHKUBO ET AL./3/, RESPECTIVELY.  NEUTRON AND RADIATION
    WIDTHS WERE DETERMINED BY DIFFERENT METHODS ACCORDING TO THE
    FOLLOWING THREE CONDITIONS, RESPECTIVELY.

    1) IN CASES WHERE TOTAL WIDTH AND NEUTRON CAPTURE AREA
    MEASURED BY MACKLIN WERE GIVEN FOR A RESONANCE LEVEL, THE
    NEUTRON AND RADIATION WIDTHS WERE SIMULTANEOUSLY OBTAINED BY
    SOLVING A QUADRATIC EQUATION.

    2) IN CASES WHERE NEUTRON CAPTURE AREA MEASURED BY MACKLIN AND
    G*(REDUCED NEUTRON WIDTH) MEASURED BY OHKUBO ET AL. WERE
    AVAILABLE, THE RADIATION WIDTHS WERE DERIVED FROM THE BOTH
    DATA.

    3) IN CASES WHERE ONLY NEUTRON CAPTURE AREA BY MACKLIN WAS
    AVAILABLE, OR G*(NEUTRON WIDTH) BY OHKUBO ET AL. WAS SMALLER
    THAN NEUTRON CAPTURE AREA BY MACKLIN, THE AVERAGE RADIATION
    WIDTH OF 308 MEV GIVEN BY MACKLIN WAS ADOPTED FOR THE LEVEL.
    THE NEUTRON WIDTH WAS DERIVED FROM THIS AVERAGE RADIATION
    WIDTH AND THE NEUTRON CAPTURE AREA.  IN ADDITION, IF THE VALUE
    OF G*(AVERAGED RADIATION WIDTH) WAS SMALLER THAN NEUTRON
    CAPTURE AREA FOR SOME RESONANCE LEVELS, THE AVERAGE RADIATION
    WIDTH WAS INCREASED DEPENDING TO THE VALUE OF NEUTRON CAPTURE
    AREA, SO AS TO SATISFY THE FOLLOWING CONDITION :
        G*(AVERAGE RADIATION WIDTH) > NEUTRON CAPTURE AREA.

    TOTAL SPIN J OF SOME RESONANCES WAS TENTATIVELY ESTIMATED WITH
    A RANDOM NUMBER METHOD.  NEUTRON ORBITAL ANGULAR MOMENTUM L
    WAS ASSUMED TO BE 0 FOR ALL RESONANCE LEVELS.  SCATTERING
    RADIUS WAS TAKEN FROM THE GRAPH (FIG. 1, PART A) GIVEN BY
    MUGHABGHAB ET AL./4/  A NEGATIVE RESONANCE WAS ADDED SO AS TO
    REPRODUCE THE THERMAL CAPTURE CROSS SECTION GIVEN BY
    MUGHABGHAB ET AL.

  UNRESOLVED RESONANCE REGION : 5.5 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/5/, AND S1 WAS BASED ON
    THE SYSTEMATICS OF MUGHABGHAB ET AL. THE OBSERVED LEVEL
    SPACING WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.  THE RADIATION WIDTH WAS BASED ON THE COMPILATION OF
    MUGHABGHAB ET AL..

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.580E-4, S1 = 1.700E-4, S2 = 0.720E-4, SG = 95.4E-4,
    GG = 0.293 EV, R  = 7.555 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL          14.27                    -
      ELASTIC         3.269                   -
      CAPTURE        11.00                  129

MF = 3  NEUTRON CROSS SECTIONS
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BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED WITH PEGASUS/6/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL. THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS SECTION BY CHANGING RO, RS AND RSO OF IIJIMA-KAWAI POTENTIAL/7/.
THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:

PROTON = PEREY/8/
ALPHA = HUIZENGA AND IGO/9/
DEUTERON = LOHR AND HAEBERLI/10/
HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/11/

PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT AND CAMERON/12/ WERE EVALUATED BY IIJIMA ET AL./13/ MORE EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE PRESENT WORK. TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED IN THE PRESENT CALCULATION. ENERGY DEPENDENCE OF SPIN CUT-OFF PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR /14/.

MT = 1 TOTAL
SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

MT = 2 ELASTIC SCATTERING
CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

MT = 4, 51 - 91 INELASTIC SCATTERING
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR STRUCTURE DATA FILE (1987 VERSION)/15/ AND NUCLEAR DATA SHEETS/16/.

NO.	ENERGY(MEV)	SPIN-PARITY
GR.	0.0	3/2 -
1	0.2071	9/2 +
2	0.2171	5/2 -
3	0.2613	3/2 -
4	0.3065	1/2 -
5	0.3836	3/2 +
6	0.3975	3/2 -
7	0.5232	5/2 -
8	0.6060	3/2 -
9	0.7614	7/2 -
10	0.7937	7/2 -
11	0.8319	1/2 -
12	0.9107	5/2 -
13	0.9543	7/2 -
14	1.0388	1/2 +
15	1.0530	5/2 -
16	1.0797	5/2 -
17	1.1125	1/2 -
18	1.1245	7/2 +
19	1.1317	1/2 +
20	1.1761	3/2 +
21	1.1919	3/2 +
22	1.2216	5/2 -
23	1.3323	3/2 -
24	1.3760	5/2 -
25	1.3951	7/2 +
26	1.4950	5/2 -
27	1.5016	1/2 +
28	1.5127	1/2 +
29	1.5751	3/2 +

LEVELS ABOVE 1.613 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/17/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (7.375E-03) WAS ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION OF 385 MILLI-BARNS AT 90 KEV MEASURED BY MACKLIN/2/.

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT = 32 (N,N'D) CROSS SECTION
MT = 33 (N,N'T) CROSS SECTION

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  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =106  (N,HE3) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
  MT =111  (N,2P) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE
    PEGASUS.

    THE KALBACH'S CONSTANT K (=  99.5) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/18/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,2N), (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,2N)        950.00  MB (MEASURED BY OKUMURA/19/)
      (N,P)          30.20  MB (SYSTEMATICS OF FORREST/20/)
      (N,ALPHA)      12.50  MB (RECOMMENDED BY FORREST/20/)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
         ----------------------  ------------  ---------------
        V  = 46.0-0.25E          R0 = 5.7      A0 = 0.62
        WS = 7.0                 RS = 6.2      AS = 0.35
        VSO= 7.0                 RSO= 5.7      ASO= 0.62
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2  LEVEL DENSITY PARAMETERS

 NUCLIDE  SYST A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
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 33-AS- 75      1.250E+01 9.510E-01 6.830E+00 1.008E+01 1.880E+00
 33-AS- 76      1.330E+01 7.860E-01 1.900E+01 5.611E+00 0.0
 33-AS- 77      1.300E+01 8.440E-01 4.637E+00 7.951E+00 1.470E+00
 33-AS- 78      1.150E+01 7.500E-01 5.001E+00 3.894E+00 0.0

 34-SE- 76      1.315E+01 8.900E-01 1.097E+00 1.082E+01 3.310E+00
 34-SE- 77      1.438E+01 8.000E-01 7.140E+00 8.015E+00 1.430E+00
 34-SE- 78      1.287E+01 8.750E-01 1.163E+00 9.882E+00 2.900E+00
 34-SE- 79      1.412E+01 8.000E-01 5.994E+00 7.842E+00 1.430E+00

 35-BR- 77   *  1.440E+01 8.442E-01 7.380E+00 9.395E+00 1.880E+00
 35-BR- 78      1.394E+01 7.570E-01 2.113E+01 5.482E+00 0.0
 35-BR- 79      1.293E+01 8.690E-01 5.790E+00 8.381E+00 1.470E+00
 35-BR- 80      1.318E+01 7.950E-01 1.882E+01 5.695E+00 0.0
 ---------------------------------------------------------------
  SYST:  * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

 SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
 IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
 ASSUMED TO BE 3.724 FOR BR- 79 AND 5.0 FOR BR- 80.

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MAT number = 3531

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 35-BR- 81 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-SEP90 REV2-MAR93
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/
93-03 JENDL-3.2 WAS MADE BY JNDC FPND W.G.

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)       UNRESOLVED RESONANCE PARAMETERS RE-ADJUSTED
                    SO AS TO REPRODUCE THE RE-NORMALIZED CAPTURE
                    CROSS SECTION.
      (3,102)       RE-NORMALIZED.
      (3,4), (3,51-91) AND ANGULAR DISTRIBUTIONS
                    SMALL EFFECTS OF THE RE-NORMALIZATION OF THE
                    CAPTURE CROSS SECTION.
     ***********************************************************


MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 13 KEV
    RESONANCE ENERGIES FOR THE 304 LEVELS AND FOR THE REMAINING 3
    LEVELS WERE BASED ON THE MEASUREMENTS BY MACKLIN/2/ AND BY
    OHKUBO ET AL./3/, RESPECTIVELY.  NEUTRON AND RADIATION WIDTHS
    WERE DETERMINED BY DIFFERENT METHODS ACCORDING TO THE
    FOLLOWING THREE CONDITIONS, RESPECTIVELY.

    1) IN CASES WHERE TOTAL WIDTH AND NEUTRON CAPTURE AREA
    MEASURED BY MACKLIN WERE GIVEN FOR A RESONANCE LEVEL, THE
    NEUTRON AND RADIATION WIDTHS WERE SIMULTANEOUSLY OBTAINED BY
    SOLVING A QUADRATIC EQUATION.

    2) IN CASES WHERE NEUTRON CAPTURE AREA MEASURED BY MACKLIN AND
    G*(REDUCED NEUTRON WIDTH) MEASURED BY OHKUBO ET AL. WERE
    AVAILABLE, THE RADIATION WIDTHS WERE DERIVED FROM THE BOTH
    DATA.

    3) IN CASES WHERE ONLY NEUTRON CAPTURE AREA BY MACKLIN WAS
    AVAILABLE, OR G*(NEUTRON WIDTH) BY OHKUBO ET AL. WAS SMALLER
    THAN NEUTRON CAPTURE AREA BY MACKLIN FOR A RESONANCE LEVEL,
    THE AVERAGE RADIATION WIDTH OF 279 MEV GIVEN BY MACKLIN WAS
    ADOPTED.  THE NEUTRON WIDTH WAS DERIVED FROM THIS AVERAGE
    RADIATION WIDTH AND THE NEUTRON CAPTURE AREA.  IN ADDITION,
    IF THE VALUE OF G*(AVERAGED RADIATION WIDTH) WAS SMALLER THAN
    NEUTRON CAPTURE AREA FOR SOME RESONANCE LEVELS, THE AVERAGE
    RADIATION WIDTH WAS INCREASED DEPENDING ON THE VALUE OF
    NEUTRON CAPTURE AREA, SO AS TO SATISFY THE FOLLOWING CONDI-
    TION:

        G*(AVERAGE RADIATION WIDTH) > NEUTRON CAPTURE AREA.

    TOTAL SPIN J OF SOME RESONANCES WAS TENTATIVELY ESTIMATED
    WITH A RANDOM NUMBER METHOD.  NEUTRON ORBITAL ANGULAR
    MOMENTUM L WAS ASSUMED TO BE 0 FOR ALL RESONANCE LEVELS.
    SCATTERING RADIUS WAS TAKEN FROM THE GRAPH (FIG. 1, PART A)
    GIVEN BY MUGHABGHAB ET AL./4/  A NEGATIVE RESONANCE WAS
    ADDED SO AS TO REPRODUCE THE THERMAL CAPTURE CROSS SECTION
    GIVEN BY MUGHABGHAB ET AL.

  UNRESOLVED RESONANCE REGION : 13 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTION S0 WAS BASED ON THE COMPILATION
    OF MUGHABGHAB ET AL., AND S1 WAS BASED ON THE SYSTEMATICS OF
    MUGHABGHAB ET AL., AND S2 WAS CALCULATED WITH OPTICAL MODEL
    CODE CASTHY/5/.  THE OBSERVED LEVEL SPACING WAS DETERMINED TO
    REPRODUCE THE CAPTURE CROSS SECTION CALCULATED WITH CASTHY.
    THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED FROM FITTING TO
    THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.  THE RADIATION
    WIDTH WAS BASED ON THE COMPILATION OF MUGHABGHAB ET AL.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.800E-4, S1 = 2.000E-4, S2 = 0.690E-4, SG = 17.3E-4,
    GG = 0.300 EV, R  = 7.334 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                      2200 M/S               RES. INTEG.
      TOTAL             6.307                    -
      ELASTIC           3.616                    -
      CAPTURE           2.690                  46.7
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MF = 3 NEUTRON CROSS SECTIONS

BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED WITH PEGASUS/6/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL. THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS SECTION BY CHANGING RO, RS AND RSO OF IIJIMA-KAWAI POTENTIAL/7/.
THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:

PROTON   = PEREY/8/
ALPHA   = HUIZENGA AND IGO/9/
DEUTERON = LOHR AND HAEBERLI/10/
HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/11/

PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT AND CAMERON/12/ WERE EVALUATED BY IIJIMA ET AL./13/ MORE EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE PRESENT WORK. TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED IN THE PRESENT CALCULATION. ENERGY DEPENDENCE OF SPIN CUT-OFF PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR /14/.

MT = 1 TOTAL

SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

MT = 2 ELASTIC SCATTERING

CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

MT = 4, 51 - 91 INELASTIC SCATTERING

SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR STRUCTURE DATA FILE (1987 VERSION)/15/ AND NUCLEAR DATA SHEETS/16/.

NO.	ENERGY(MEV)	SPIN-PARITY
GR.	0.0	3/2 -
1	0.2760	5/2 -
2	0.5362	9/2 +
3	0.5382	1/2 -
4	0.5660	3/2 -
5	0.6499	3/2 -
6	0.7672	3/2 -
7	0.7925	3/2 +
8	0.8150	1/2 +
9	0.8283	3/2 -
10	0.8324	1/2 -
11	0.8364	7/2 -
12	1.1047	1/2 -
13	1.1899	5/2 -
14	1.2666	3/2 -
15	1.3228	5/2 -
16	1.3275	5/2 -
17	1.3525	1/2 -
18	1.3757	7/2 +
19	1.5428	1/2 -
20	1.5870	1/2 +
21	1.9499	7/2 +
22	1.9852	3/2 +
23	2.0559	1/2 -
24	2.0846	7/2 +
25	2.1225	3/2 +
26	2.1641	1/2 -

LEVELS ABOVE 2.193 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE

SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/17/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (1.65E-03) WAS ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION OF 119 MILLI-BARNS AT 90 KEV MEASURED BY MACKLIN/2/.

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT = 32 (N,N'D) CROSS SECTION
MT = 33 (N,N'T) CROSS SECTION
MT =103 (N,P) CROSS SECTION

MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 120.9) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/18/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,P)	21.50 MB	(RECOMMENDED BY FORREST/19/)
(N,ALPHA)	5.00 MB	(RECOMMENDED BY FORREST)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 46.0-0.25E	R0 = 5.7	A0 = 0.62
WS = 7.0	RS = 6.2	AS = 0.35
VSO= 7.0	RSO= 5.7	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
33-AS- 77	1.300E+01	8.440E-01	4.637E+00	7.951E+00	1.470E+00
33-AS- 78	1.150E+01	7.500E-01	5.001E+00	3.894E+00	0.0
33-AS- 79	1.290E+01	8.230E-01	3.020E+00	7.585E+00	1.570E+00
33-AS- 80	1.150E+01	7.250E-01	4.181E+00	3.535E+00	0.0
34-SE- 78	1.287E+01	8.750E-01	1.163E+00	9.882E+00	2.900E+00
34-SE- 79	1.412E+01	8.000E-01	5.994E+00	7.842E+00	1.430E+00
34-SE- 80	1.334E+01	8.130E-01	6.129E-01	9.136E+00	3.000E+00
34-SE- 81	1.368E+01	7.490E-01	2.463E+00	6.614E+00	1.430E+00
35-BR- 79	1.293E+01	8.690E-01	5.790E+00	8.381E+00	1.470E+00
35-BR- 80	1.318E+01	7.950E-01	1.882E+01	5.695E+00	0.0
35-BR- 81	1.290E+01	8.310E-01	3.275E+00	7.733E+00	1.570E+00
35-BR- 82	1.266E+01	6.900E-01	5.789E+00	3.665E+00	0.0

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 3.192 FOR BR- 81 AND 5.0 FOR BR- 82.

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MAT number = 3625

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 36-KR- 78 JNDC        EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                       DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 0.8 KEV
    RESONANCE PARAMETERS FOR THREE POSITIVE LEVELS WERE BASED ON
    MUGHABGHAB ET AL./2/  RESONANCE LEVELS AT 0.1719 KEV AND ABOVE
    1.136 KEV WERE ABANDONED, BECAUSE THEY BELONG POSSIBLY TO
    KR-80.  THE VALUES OF NEUTRON ORBITAL ANGULAR MOMENTUM L AND
    TOTAL SPIN J WERE ASSUMED TO BE 0 AND 0.5 FOR ALL RESONANCE
    LEVELS, RESPECTIVELY.  SCATTERING RADIUS WAS ALSO TAKEN FROM
    THE GRAPH (FIG. 1, PART A) GIVEN BY MUGHABGHAB ET AL.  A
    NEGATIVE RESONANCE WAS ADDED SO AS TO REPRODUCE THE THERMAL
    CAPTURE CROSS SECTION OF 6.2+-0.9 BARNS GIVEN BY MUGHABGHAB ET
    AL.

  UNRESOLVED RESONANCE REGION : 0.8 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0 AND S2 WERE CALCULATED WITH
    OPTICAL MODEL CODE CASTHY/3/, AND S1 WAS BASED ON THE
    SYSTEMATICS OF MUGHABGHAB ET AL.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.  THE RADIATION WIDTH GG WAS BASED ON THE COMPILATION
    OF MUGHABGHAB ET AL.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.580E-4, S1 = 1.700E-4, S2 = 0.730E-4, SG = 13.0E-4,
    GG = 0.230 EV, R  = 7.556 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL         14.03                      -
      ELASTIC        7.829                     -
      CAPTURE        6.200                    25.8

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/4/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING RO, RS AND RSO OF IIJIMA-KAWAI POTENTIAL/5/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/6/
     ALPHA    = HUIZENGA AND IGO/7/
     DEUTERON = LOHR AND HAEBERLI/8/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/9/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/10/ WERE EVALUATED BY IIJIMA ET AL./11/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /12/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/13/ AND AND NUCLEAR DATA
    SHEETS/14/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             0  +
            1        0.4550          2  +
            2        1.0172          0  +
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3	1.1195	4	+
4	1.1479	2	+
5	1.5647	3	+
6	1.6538	3	+
7	1.7559	2	+
8	1.7729	2	+
9	1.8729	4	+
10	1.9778	6	+
11	2.0075	0	-
12	2.2341	2	+
13	2.2407	2	+
14	2.2998	5	+
15	2.3990	3	-
16	2.4134	2	+
17	2.4434	1	-
18	2.4718	2	+
19	2.5080	0	+
20	2.5733	2	+
21	2.6561	0	+
22	2.6776	3	-
23	2.7315	6	+
24	2.7498	5	-
25	2.7641	3	-
26	2.8821	3	-
27	2.8828	1	-
28	2.9925	0	+
29	2.9933	8	+

LEVELS ABOVE 2.999 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/15/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (10.3E-04) WAS ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION OF 200 MILLI-BARNS AT 100 KEV MEASURED BY WALTER ET AL./16/

MT = 16 (N,2N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =106 (N,HE3) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
MT =111 (N,2P) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 85.5) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/17/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,2N), (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,2N)	245.00	MB	(MEASURED BY KONDAIAH+/18/)
(N,P)	131.00	MB	(SYSTEMATICS OF FORREST/19/)
(N,ALPHA)	39.30	MB	(SYSTEMATICS OF FORREST)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 46.0-0.25E	R0 = 5.7	A0 = 0.62
WS = 7.0	RS = 6.2	AS = 0.35

VSO= 7.0 RSO= 5.7 ASO= 0.62
THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
34-SE- 74		1.290E+01	8.620E-01	1.070E+00	9.612E+00	2.860E+00
34-SE- 75		1.391E+01	8.500E-01	9.741E+00	8.707E+00	1.430E+00
34-SE- 76		1.315E+01	8.900E-01	1.097E+00	1.082E+01	3.310E+00
34-SE- 77		1.438E+01	8.000E-01	7.140E+00	8.015E+00	1.430E+00
35-BR- 75	*	1.407E+01	8.667E-01	1.329E+01	9.176E+00	1.430E+00
35-BR- 76	*	1.467E+01	8.553E-01	9.334E+01	7.957E+00	0.0
35-BR- 77	*	1.440E+01	8.442E-01	7.380E+00	9.395E+00	1.880E+00
35-BR- 78		1.394E+01	7.570E-01	2.113E+01	5.482E+00	0.0
36-KR- 76	*	1.425E+01	8.553E-01	3.339E+00	1.024E+01	2.600E+00
36-KR- 77		1.359E+01	8.250E-01	7.930E+00	7.711E+00	1.170E+00
36-KR- 78		1.322E+01	8.690E-01	1.155E+00	1.019E+01	3.050E+00
36-KR- 79		1.369E+01	8.400E-01	9.969E+00	8.080E+00	1.170E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 6.780 FOR KR- 78 AND 5.0 FOR KR- 79.

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MAT number = 3631

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 36-KR- 80 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 1 KEV
    RESONANCE PARAMETERS WERE BASED ON MUGHABGHAB ET AL./2/
    RESONANCE LEVELS AT 89.2 AND 171.9 EV, AND ABOVE 2.16 KEV WERE
    ABANDONED, BECAUSE THEY DO NOT POSSIBLY BELONG TO KR-80.
    NEUTRON WIDTHS OF THE RESONANCE LEVELS ABOVE 1.136 KEV WERE
    DERIVED FROM THE AVERAGE REDUCED NEUTRON WIDTH OF 18.34 MEV.
    AVERAGE RADIATION WIDTH OF 0.23 EV WAS ADOPTED FOR ALL
    RESONANCE LEVELS EXCEPT THE FIRST LEVEL AT 106 EV.  THE VALUES
    OF NEUTRON ORBITAL ANGULAR MOMENTUM L AND TOTAL SPIN J
    WERE ASSUMED TO BE 0 AND 0.5 FOR ALL RESONANCE LEVELS,
    RESPECTIVELY.  SCATTERING RADIUS WAS ALSO TAKEN FROM THE GRAPH
    (FIG. 1, PART A) GIVEN BY MUGHABGHAB ET AL.  A NEGATIVE
    RESONANCE WAS ADDED SO AS TO REPRODUCE THE THERMAL CAPTURE
    CROSS SECTION OF 11.5+-0.5 BARNS GIVEN BY MUGHABGHAB ET AL.

  UNRESOLVED RESONANCE REGION : 1 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/3/, AND S1 WAS BASED ON THE
    SYSTEMATICS OF MUGHABGHAB ET AL.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION
    AT 100 KEV.  THE RADIATION WIDTH WAS BASED ON THE COMPILATION
    OF MUGHABGHAB ET AL.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.580E-4, S1 = 1.800E-4, S2 = 0.700E-4, SG = 8.51E-4,
    GG = 0.230 EV, R  = 7.513 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL          18.79                     -
      ELASTIC         7.290                    -
      CAPTURE        11.50                    60.2

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/4/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING RO, RS AND RSO OF IIJIMA-KAWAI POTENTIAL/5/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/6/
     ALPHA    = HUIZENGA AND IGO/7/
     DEUTERON = LOHR AND HAEBERLI/8/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/9/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/10/ WERE EVALUATED BY IIJIMA ET AL./11/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /12/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/13/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0              0  +
```

1	0.6166	2	+
2	1.2562	2	+
3	1.3205	0	+
4	1.4360	4	+
5	1.7879	3	+
6	2.1458	4	+
7	2.3918	6	+
8	2.4390	3	-
9	2.6595	5	+
10	2.7928	4	-
11	2.8594	5	-
12	2.9570	3	-
13	3.0390	5	-
14	3.0416	6	-
15	3.1100	6	+
16	3.3455	6	-
17	3.4096	8	+
18	3.4878	5	-
19	3.5300	7	-
20	3.5583	7	-
21	3.5815	7	-
22	3.6352	7	+
23	3.6994	8	+
24	3.9158	6	+
25	4.1258	6	-
26	4.1530	6	-
27	4.1631	8	-
28	4.3771	10	+
29	4.3929	9	-

LEVELS ABOVE 4.562 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/14/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (6.99E-04) WAS ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION OF 150 MILLI-BARNS AT 100 KEV MEASURED BY WALTER ET AL./15/

MT = 16 (N,2N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =106 (N,HE3) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
MT =111 (N,2P) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 69.7) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/16/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,P)	54.90 MB	(SYSTEMATICS OF FORREST/17/)
(N,ALPHA)	18.80 MB	(SYSTEMATICS OF FORREST)

MT = 251 MU-BAR
CALCULATED WITH CASTHY/3/.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 46.0-0.25E	R0 = 5.7	A0 = 0.62

WS = 7.0 RS = 6.2 AS = 0.35
VSO= 7.0 RSO= 5.7 ASO= 0.62
THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
34-SE- 76		1.315E+01	8.900E-01	1.097E+00	1.082E+01	3.310E+00
34-SE- 77		1.438E+01	8.000E-01	7.140E+00	8.015E+00	1.430E+00
34-SE- 78		1.287E+01	8.750E-01	1.163E+00	9.882E+00	2.900E+00
34-SE- 79		1.412E+01	8.000E-01	5.994E+00	7.842E+00	1.430E+00
35-BR- 77	*	1.440E+01	8.442E-01	7.380E+00	9.395E+00	1.880E+00
35-BR- 78		1.394E+01	7.570E-01	2.113E+01	5.482E+00	0.0
35-BR- 79		1.293E+01	8.690E-01	5.790E+00	8.381E+00	1.470E+00
35-BR- 80		1.318E+01	7.950E-01	1.882E+01	5.695E+00	0.0
36-KR- 78		1.322E+01	8.690E-01	1.155E+00	1.019E+01	3.050E+00
36-KR- 79		1.369E+01	8.400E-01	9.969E+00	8.080E+00	1.170E+00
36-KR- 80		1.205E+01	8.350E-01	5.500E-01	8.257E+00	2.640E+00
36-KR- 81		1.503E+01	7.300E-01	6.057E+00	6.776E+00	1.170E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 20.15 FOR KR- 80 AND 5.0 FOR KR- 81.

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MAT number = 3637

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 36-KR- 82 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 0.4 KEV
    RESONANCE PARAMETERS WERE BASED ON MUGHABGHAB ET AL./2/  THE
    RESONANCE LEVEL AT 1.55 KEV WAS ABANDONED, BECAUSE THIS LEVEL
    BELONGS POSSIBLY TO KR-83.  NEUTRON WIDTHS OF THE RESONANCE
    LEVELS FROM 646 TO 1659 EV WERE DERIVED FROM THE REDUCED
    NEUTRON WIDTH (19.7 MEV) OF THE 1ST LEVEL AND THE RESONANCE
    ENERGY OF EACH LEVEL.  AVERAGE RADIATION WIDTH OF 230 MEV
    GIVEN BY MUGHABGHAB ET AL. WAS ADOPTED FOR ALL RESONANCE
    LEVELS INCLUDING A NEGATIVE RESONANCE, AND WAS SLIGHTLY
    MODIFIED TO 227 MEV SO AS TO REPRODUCE THE THERMAL CAPTURE
    CROSS SECTION OF 28+-20 BARNS GIVEN BY MUGHABGHAB ET AL.  THE
    VALUES OF NEUTRON ORBITAL ANGULAR MOMENTUM L AND TOTAL SPIN J
    WERE ASSUMED TO BE 0 AND 0.5 FOR ALL RESONANCE LEVELS,
    RESPECTIVELY.  SCATTERING RADIUS WAS ALSO TAKEN FROM THE GRAPH
    (FIG. 1, PART A) GIVEN BY MUGHABGHAB ET AL.

  UNRESOLVED RESONANCE REGION : 0.4 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/3/, AND S1 WAS BASED ON THE
    SYSTEMATICS OF MUGHABGHAB ET AL.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION
    AT 100 KEV.  THE RADIATION WIDTH WAS BASED ON THE COMPILATION
    OF MUGHABGHAB ET AL.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.580E-4, S1 = 2.100E-4, S2 = 0.680E-4, SG = 1.85E-4,
    GG = 0.230 EV, R  = 7.392 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL          46.46                     -
      ELASTIC        18.46                     -
      CAPTURE        28.00                    228

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/4/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING R0, RS AND RSO OF IIJIMA-KAWAI POTENTIAL/5/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/6/
     ALPHA    = HUIZENGA AND IGO/7/
     DEUTERON = LOHR AND HAEBERLI/8/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/9/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/10/ WERE EVALUATED BY IIJIMA ET AL./11/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /12/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/13/
    AND NUCLEAR DATA SHEETS/14/.
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            NO.       ENERGY(MEV)    SPIN-PARITY
            GR.        0.0             0  +
             1         0.7765          2  +
             2         1.4748          2  +
             3         1.4875          3  -
             4         1.8205          4  +
             5         1.9566          1  -
             6         2.0939          3  +
             7         2.1718          0  +
             8         2.4268          3  +
             9         2.4801          1  -
            10         2.5474          3  -
            11         2.5561          3  -
            12         2.6483          4  -
            13         2.8280          5  -
            14         2.9200          6  +
       LEVELS ABOVE 2.944 MEV WERE ASSUMED TO BE OVERLAPPING.
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MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/15/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (1.69E-04) WAS ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION OF 50 MILLI-BARNS AT 100 KEV MEASURED BY WALTER ET AL./16/

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 78.0) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/17/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

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  (N,P)          23.00  MB (RECOMMENDED BY FORREST/18/)
  (N,ALPHA)       8.21  MB (SYSTEMATICS OF FORREST/18/)
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MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

	DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
	V = 46.0-0.25E	R0 = 5.7	A0 = 0.62
	WS = 7.0	RS = 6.2	AS = 0.35
	VSO= 7.0	RSO= 5.7	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
34-SE- 78		1.287E+01	8.750E-01	1.163E+00	9.882E+00	2.900E+00
34-SE- 79		1.412E+01	8.000E-01	5.994E+00	7.842E+00	1.430E+00
34-SE- 80		1.334E+01	8.130E-01	6.129E-01	9.136E+00	3.000E+00
34-SE- 81		1.368E+01	7.490E-01	2.463E+00	6.614E+00	1.430E+00
35-BR- 79		1.293E+01	8.690E-01	5.790E+00	8.381E+00	1.470E+00

35-BR- 80	1.318E+01	7.950E-01	1.882E+01	5.695E+00	0.0
35-BR- 81	1.290E+01	8.310E-01	3.275E+00	7.733E+00	1.570E+00
35-BR- 82	1.266E+01	6.900E-01	5.789E+00	3.665E+00	0.0
36-KR- 80	1.205E+01	8.350E-01	5.500E-01	8.257E+00	2.640E+00
36-KR- 81	1.503E+01	7.300E-01	6.057E+00	6.776E+00	1.170E+00
36-KR- 82	1.319E+01	7.810E-01	4.961E-01	8.191E+00	2.740E+00
36-KR- 83	1.483E+01	6.700E-01	2.532E+00	5.589E+00	1.170E+00

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 6.839 FOR KR- 82 AND 8.5 FOR KR- 83.

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MAT number = 3640

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 36-KR- 83 JNDC        EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                       DIST-NOV90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 0.272 KEV
    RESONANCE PARAMETERS OF JENDL-2 WERE MODIFIED AS FOLLOWS :
    FOR JENDL-2, PARAMETERS WERE GIVEN FOR 2 POSITIVE AND A
    NEGATIVE RESONANCES ON THE BASIS OF THE DATA GIVEN BY
    MUGHABGHAB ET AL./3/  NEUTRON ORBITAL ANGULAR MOMENTUM L WERE
    ASSUMED TO BE 0.  NEUTRON WIDTHS WERE MODIFIED SO AS TO
    REPRODUCE THE THERMAL CAPTURE CROSS SECTION OF 180+-30 BARNS
    AND THE NEUTRON RESONANCE CAPTURE INTEGRAL OF 183+-25 BARNS
    GIVEN BY MUGHABGHAB ET AL.  RADIATION WIDTH OF 210 MEV FOR THE
    FIRST LEVEL/3/ WAS ADOPTED FOR THE OTHER RESONANCE LEVELS.
    HOWEVER, THE VALUES OF TOTAL SPIN J WERE UNKNOWN AND THE
    TARGET SPIN OF 4.5 WAS ADOPTED FOR ALL THE LEVELS.

    FOR JENDL-3, THE J-VALUES OF ALL RESONANCE LEVELS WERE
    TENTATIVELY ESTIMATED WITH A RANDOM NUMBER METHOD.  ACCORDING
    TO MODIFICATION OF THE J-VALUES, RESONANCE PARAMETERS WERE
    ALSO MODIFIED SO AS TO REPRODUCE THE THERMAL CAPTURE CROSS
    SECTION AND THE NEUTRON RESONANCE CAPTURE INTEGRAL MENTIONED
    ABOVE.  SCATTERING RADIUS WAS TAKEN FROM THE GRAPH (FIG. 1,
    PART A) GIVEN BY MUGHABGHAB ET AL.

  UNRESOLVED RESONANCE REGION : 0.272 KEV - 100 KEV
    UNRESOLVED RESONANCE PARAMETERS WERE ADOPTED FROM JENDL-2.
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/4/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.580E-4, S1 = 2.920E-4, S2 = 0.650E-4, SG = 25.2E-4,
    GG = 0.200 EV, R  = 7.033 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                      2200 M/S               RES. INTEG.
      TOTAL          189.0                       -
      ELASTIC          9.080                     -
      CAPTURE        179.9                      148

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/5/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING R0, RS AND RSO OF IIJIMA-KAWAI POTENTIAL/6/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/7/
     ALPHA    = HUIZENGA AND IGO/8/
     DEUTERON = LOHR AND HAEBERLI/9/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/10/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/11/ WERE EVALUATED BY IIJIMA ET AL./12/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /13/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
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ADOPTED. THE LEVEL SCHEME WAS TAKEN FROM REF./14/.

NO.	ENERGY(MEV)	SPIN-PARITY
GR.	0.0	9/2 +
1	0.0094	7/2 +
2	0.0416	1/2 -
3	0.5619	5/2 -
4	0.5711	3/2 -
5	0.6900	3/2 +
6	0.7983	5/2 +
7	1.0120	11/2 +
8	1.1028	9/2 +
9	1.1222	13/2 +

LEVELS ABOVE 1.21 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/15/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (25.9E-04) WAS ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION OF 272 MILLI-BARNS AT 30 KEV MEASURED BY WALTER ET AL./16/

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT = 32 (N,N'D) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =106 (N,HE3) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
MT =111 (N,2P) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 266.2) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/17/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
(N,P) 14.00 MB (RECOMMENDED BY FORREST/18/)
(N,ALPHA) 5.28 MB (SYSTEMATICS OF FORREST/18/)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 46.0-0.25E	R0 = 5.7	A0 = 0.62
WS = 7.0	RS = 6.2	AS = 0.35
VSO= 7.0	RSO= 5.7	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
34-SE- 79	1.412E+01	8.000E-01	5.994E+00	7.842E+00	1.430E+00
34-SE- 80	1.334E+01	8.130E-01	6.129E-01	9.136E+00	3.000E+00
34-SE- 81	1.368E+01	7.490E-01	2.463E+00	6.614E+00	1.430E+00
34-SE- 82	1.259E+01	7.980E-01	3.563E-01	8.246E+00	2.890E+00
35-BR- 80	1.318E+01	7.950E-01	1.882E+01	5.695E+00	0.0

35-BR- 81	1.290E+01	8.310E-01	3.275E+00	7.733E+00	1.570E+00
35-BR- 82	1.266E+01	6.900E-01	5.789E+00	3.665E+00	0.0
35-BR- 83	1.324E+01	7.830E-01	2.683E+00	6.978E+00	1.460E+00
36-KR- 81	1.503E+01	7.300E-01	6.057E+00	6.776E+00	1.170E+00
36-KR- 82	1.319E+01	7.810E-01	4.961E-01	8.191E+00	2.740E+00
36-KR- 83	1.483E+01	6.700E-01	2.532E+00	5.589E+00	1.170E+00
36-KR- 84	9.970E+00	9.600E-01	4.942E-01	8.590E+00	2.630E+00

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 8.5 FOR KR- 83 AND 4.937 FOR KR- 84.

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MAT number = 3643

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 36-KR- 84 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 2.48 KEV
    EVALUATION OF JENDL-2 WAS PERFORMED AS FOLLOWS :
    NEUTRON WIDTHS AND AVERAGE RADIATION WIDTH FOR THE TWO
    POSITIVE LEVELS AT 519 AND 580 EV WERE TAKEN FROM THE DATA
    GIVEN BY MUGHABGHAB ET AL./3/  THE SIX RESONANCE LEVELS FROM
    1.164 TO 2.12 KEV WERE ABANDONED, BECAUSE THEIR ISOTOPIC
    ASSIGNMENT WAS UNCERTAIN.  THE VALUE OF AVERAGE RADIATION
    WIDTH WAS MODIFIED TO 121 MEV SO AS TO REPRODUCE THE NEUTRON
    RESONANCE CAPTURE INTEGRAL OF 2.43+-0.2 BARNS GIVEN BY
    MUGHABGHAB ET AL.  THE VALUES OF NEUTRON ORBITAL ANGULAR
    MOMENTUM L AND TOTAL SPIN J WERE ASSUMED TO BE 0 AND 0.5,
    RESPECTIVELY.  SCATTERING RADIUS WAS ALSO TAKEN FROM THE GRAPH
    (FIG. 1, PART A) GIVEN BY MUGHABGHAB ET AL.  A NEGATIVE
    RESONANCE WAS ADDED AT -150 EV SO AS TO REPRODUCE THE THERMAL
    CAPTURE CROSS SECTION OF 0.110+-0.015 BARNS/3/.

    FOR JENDL-3, ANY MODIFICATION WAS NOT MADE, BECAUSE NEW
    MEASUREMENTS HAVE NOT BEEN CARRIED OUT.

  UNRESOLVED RESONANCE REGION : 2.48 KEV - 100 KEV
    UNRESOLVED RESONANCE PARAMETERS WERE ADOPTED FROM JENDL-2.
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/4/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.580E-4, S1 = 2.920E-4, S2 = 0.650E-4, SG = 0.553E-4,
    GG = 0.200 EV, R  = 7.061 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S                RES. INTEG.
      TOTAL           6.269                      -
      ELASTIC         6.159                      -
      CAPTURE         0.1100                      2.42

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/5/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING R0, RS AND RSO OF IIJIMA-KAWAI POTENTIAL/6/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/7/
     ALPHA    = HUIZENGA AND IGO/8/
     DEUTERON = LOHR AND HAEBERLI/9/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/10/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/11/ WERE EVALUATED BY IIJIMA ET AL./12/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /13/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./14/.
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NO.	ENERGY(MEV)	SPIN-PARITY
GR.	0.0	0 +
1	0.8820	2 +
2	1.8340	0 +
3	1.9000	2 +
4	2.0860	4 +
5	2.3370	4 +
6	2.6260	2 +
7	2.7050	3 -
8	2.7590	1 +
9	2.7750	2 +
10	3.0480	3 +
11	3.2250	1 -
12	3.3350	2 -
13	3.4770	1 -
14	3.5700	3 -
15	3.6500	5 -
16	3.7210	3 -

LEVELS ABOVE 3.795 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/15/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (0.533E-04) WAS ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION OF 38.7 MILLI-BARNS AT 30 KEV MEASURED BY WALTER ET AL./16/

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 254.6) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/17/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,P)	9.33 MB	(SYSTEMATICS OF FORREST/18/)
(N,ALPHA)	3.33 MB	(SYSTEMATICS OF FORREST)

MT = 251 MU-BAR
CALCULATED WITH CASTHY/4/.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 46.0-0.25E	R0 = 5.7	A0 = 0.62
WS = 7.0	RS = 6.2	AS = 0.35
VSO= 7.0	RSO= 5.7	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
34-SE- 80		1.334E+01	8.130E-01	6.129E-01	9.136E+00	3.000E+00
34-SE- 81		1.368E+01	7.490E-01	2.463E+00	6.614E+00	1.430E+00
34-SE- 82		1.259E+01	7.980E-01	3.563E-01	8.246E+00	2.890E+00
34-SE- 83		1.381E+01	7.500E-01	2.666E+00	6.708E+00	1.430E+00

35-BR- 81		1.290E+01	8.310E-01	3.275E+00	7.733E+00	1.570E+00
35-BR- 82		1.266E+01	6.900E-01	5.789E+00	3.665E+00	0.0
35-BR- 83		1.324E+01	7.830E-01	2.683E+00	6.978E+00	1.460E+00
35-BR- 84	*	1.302E+01	7.738E-01	1.393E+01	5.216E+00	0.0
36-KR- 82		1.319E+01	7.810E-01	4.961E-01	8.191E+00	2.740E+00
36-KR- 83		1.483E+01	6.700E-01	2.532E+00	5.589E+00	1.170E+00
36-KR- 84		9.970E+00	9.600E-01	4.942E-01	8.590E+00	2.630E+00
36-KR- 85		1.024E+01	8.900E-01	1.570E+00	6.261E+00	1.170E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 4.937 FOR KR- 84 AND 3.125 FOR KR- 85.

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MAT number = 3646

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 36-KR- 85 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  NO RESOLVED RESONANCE PARAMETERS

  UNRESOLVED RESONANCE REGION : 1.0 KEV - 100 KEV
    UNRESOLVED RESONANCE PARAMETERS WERE ADOPTED FROM JENDL-2.
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/3/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.580E-4, S1 = 2.920E-4, S2 = 0.650E-4, SG = 3.60E-4,
    GG = 0.200 EV, R  = 7.056 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL            7.916                    -
      ELASTIC          6.256                    -
      CAPTURE          1.660                     1.82

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 1.0 KEV, THE CAPTURE AND ELASTIC SCATTERING CROSS SECTIONS
  WERE ASSUMED TO BE IN 1/V FORM AND CONSTANT, RESPECTIVELY.  THE
  CAPTURE CROSS SECTION AT 0.0253 EV WAS TAKEN FROM REF./4/, AND
  THE SCATTERING CROSS SECTION WAS ESTIMATED BY ASSUMING R = 6.7
  FM.  UNRESOLVED RESONANCE PARAMETERS WERE GIVEN IN THE ENERGY
  RANGE FROM 1.0 KEV TO 100 KEV.

  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/5/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING R0, RS AND RSO OF IIJIMA-KAWAI POTENTIAL
  /6/.  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/7/
     ALPHA    = HUIZENGA AND IGO/8/
     DEUTERON = LOHR AND HAEBERLI/9/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/10/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/11/ WERE EVALUATED BY IIJIMA ET AL./12/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /13/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./14/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0            9/2 +
            1        0.3049         1/2 -
            2        1.1073         3/2 -
            3        1.1408         5/2 +
            4        1.1666         3/2 +
            5        1.2239         3/2 -
            6        1.3427         3/2 +
            7        1.4168         5/2 +
            8        1.8737         5/2 +
            9        1.9389         5/2 -
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          10        2.0319         5/2 -
          11        2.1374         3/2 -
          12        2.4634         5/2 -
     LEVELS ABOVE 2.7 MEV WERE ASSUMED TO BE OVERLAPPING.

   MT = 102  CAPTURE
     SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
     CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
     SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
     AND REFFO/15/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

     THE GAMMA-RAY STRENGTH FUNCTION (3.86E-04) WAS DETERMINED FROM
     THE SYSTEMATICS OF RADIATION WIDTH (0.193 EV) AND THE AVERAGE
     S-WAVE RESONANCE LEVEL SPACING (500 EV) CALCULATED FROM THE
     LEVEL DENSITY PARAMETERS.

   MT = 16  (N,2N) CROSS SECTION
   MT = 17  (N,3N) CROSS SECTION
   MT = 22  (N,N'A) CROSS SECTION
   MT = 28  (N,N'P) CROSS SECTION
   MT = 32  (N,N'D) CROSS SECTION
   MT =103  (N,P) CROSS SECTION
   MT =104  (N,D) CROSS SECTION
   MT =105  (N,T) CROSS SECTION
   MT =107  (N,ALPHA) CROSS SECTION
     THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
     PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

     THE KALBACH'S CONSTANT K (= 381.7) WAS ESTIMATED BY THE
     FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/16/ AND LEVEL
     DENSITY PARAMETERS.

     FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
     NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
       (N,P)           5.96  MB (SYSTEMATICS OF FORREST/17/)
       (N,ALPHA)       2.07  MB (SYSTEMATICS OF FORREST)

   MT = 251  MU-BAR
     CALCULATED WITH CASTHY.

 MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
   LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
   GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
   TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
   CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
   BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

 MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
   ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
   PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
   OTHER NEUTRON EMITTING REACTIONS.

 TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                 DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
          ----------------------  ------------  ---------------
         V  = 46.0-0.25E           R0 = 5.7      A0 = 0.62
         WS = 7.0                  RS = 6.2      AS = 0.35
         VSO= 7.0                  RSO= 5.7      ASO= 0.62
   THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

 TABLE 2  LEVEL DENSITY PARAMETERS

  NUCLIDE  SYST A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
  ---------------------------------------------------------------
  34-SE- 81      1.368E+01 7.490E-01 2.463E+00 6.614E+00 1.430E+00
  34-SE- 82      1.259E+01 7.980E-01 3.563E-01 8.246E+00 2.890E+00
  34-SE- 83      1.381E+01 7.500E-01 2.666E+00 6.708E+00 1.430E+00
  34-SE- 84   *  8.736E+00 7.738E-01 6.479E-02 4.692E+00 2.360E+00

  35-BR- 82      1.266E+01 6.900E-01 5.789E+00 3.665E+00 0.0
  35-BR- 83      1.324E+01 7.830E-01 2.683E+00 6.978E+00 1.460E+00
  35-BR- 84   *  1.302E+01 7.738E-01 1.393E+01 5.216E+00 0.0
  35-BR- 85      1.100E+01 7.000E-01 7.248E-01 3.841E+00 9.300E-01

  36-KR- 83      1.483E+01 6.700E-01 2.532E+00 5.589E+00 1.170E+00
  36-KR- 84      9.970E+00 9.600E-01 4.942E-01 8.590E+00 2.630E+00
  36-KR- 85      1.024E+01 8.900E-01 1.570E+00 6.261E+00 1.170E+00
  36-KR- 86      9.052E+00 8.686E-01 2.185E-01 5.874E+00 2.100E+00
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   SYST:  * = LDP'S WERE DETERMINED FROM SYSTEMATICS.
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SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 3.125 FOR KR- 85 AND 4.225 FOR KR- 86.

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MAT number = 3649

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 36-KR- 86 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 640 KEV
    EVALUATION OF RESONANCE ENERGIES, NEUTRON WIDTHS, NEUTRON
    ORBITAL ANGULAR MOMENTUM L AND TOTAL SPIN J WAS BASED ON THE
    DATA MEASURED BY CARLTON ET AL./3/ AND BY RAMAN ET AL./4/
    RADIATION WIDTHS FOR THE 12 RESONANCE LEVELS IN THE ENERGY
    RANGE FROM 19.238 TO 88.329 KEV WERE TAKEN FROM THE DATA BY
    RAMAN ET AL.  THE VALUE OF AVERAGE RADIATION WIDTH WAS
    DETERMINED SO THAT THE AVERAGE CAPTURE CROSS SECTION AROUND
    640 KEV MIGHT AGREE WITH THAT CALCULATED BY CASTHY/5/, AND
    THUS OBTAINED AVERAGE RADIATION WIDTH WAS ADOPTED FOR THE
    RESONANCE LEVELS WHOSE RADIATION WIDTH WAS UNKNOWN.
    SCATTERING RADIUS WAS TAKEN FROM THE GRAPH (FIG. 1, PART A)
    GIVEN BY MUGHABGHAB ET AL./6/  A NEGATIVE RESONANCE WAS ADDED
    AT -20 KEV SO AS TO REPRODUCE THE THERMAL CAPTURE CROSS
    SECTION OF 3 MB GIVEN BY MUGHABGHAB ET AL.

  NO UNRESOLVED RESONANCE REGION

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           6.153                    -
      ELASTIC         6.150                    -
      CAPTURE         0.003000                  0.0232

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 640 KEV, RESOLVED RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 640 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY/5/, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/7/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING RO, RS AND RSO OF IIJIMA-KAWAI POTENTIAL/8/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/9/
     ALPHA    = HUIZENGA AND IGO/10/
     DEUTERON = LOHR AND HAEBERLI/11/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/12/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/13/ WERE EVALUATED BY IIJIMA ET AL./14/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /15/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./16/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             0  +
            1        1.5646          2  +
            2        2.2480          4  +
            3        2.3496          2  +
            4        2.7330          0  +
            5        2.8502          3  +
            6        2.9262          2  +
            7        3.0992          3  -
            8        3.5420          0  +
            9        3.8320          0  +
           10        3.9590          4  +
      LEVELS ABOVE 4.072 MEV WERE ASSUMED TO BE OVERLAPPING.
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MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/17/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (3.55E-6) WAS ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION OF 2.5 MILLI-BARNS AT 100 KEV MEASURED BY WALTER/18/

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS/7/.

THE KALBACH'S CONSTANT K (= 352.9) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/19/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,P)	8.00 MB	(RECOMMENDED BY FORREST/20/)
(N,ALPHA)	1.27 MB	(SYSTEMATICS OF FORREST/20/)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 46.0-0.25E	R0 = 5.7	A0 = 0.62
WS = 7.0	RS = 6.2	AS = 0.35
VSO= 7.0	RSO= 5.7	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
34-SE- 82		1.259E+01	7.980E-01	3.563E-01	8.246E+00	2.890E+00
34-SE- 83		1.381E+01	7.500E-01	2.666E+00	6.708E+00	1.430E+00
34-SE- 84	*	8.736E+00	7.738E-01	6.479E-02	4.692E+00	2.360E+00
34-SE- 85	*	9.605E+00	7.647E-01	3.056E-01	4.293E+00	1.430E+00
35-BR- 83		1.324E+01	7.830E-01	2.683E+00	6.978E+00	1.460E+00
35-BR- 84	*	1.302E+01	7.738E-01	1.393E+01	5.216E+00	0.0
35-BR- 85		1.100E+01	7.000E-01	7.248E-01	3.841E+00	9.300E-01
35-BR- 86	*	9.718E+00	7.558E-01	1.999E+00	2.830E+00	0.0
36-KR- 84		9.970E+00	9.600E-01	4.942E-01	8.590E+00	2.630E+00
36-KR- 85		1.024E+01	8.900E-01	1.570E+00	6.261E+00	1.170E+00
36-KR- 86		9.052E+00	8.686E-01	2.185E-01	5.874E+00	2.100E+00
36-KR- 87		9.400E+00	8.860E-01	8.826E-01	5.481E+00	1.170E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 4.225 FOR KR- 86 AND 5.0 FOR KR- 87.

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MAT number = 3725
 37-RB- 85 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 8.468 KEV
    RESONANCE PARAMETERS OF JENDL-2 WERE MODIFIED AS FOLLOWS :
    EVALUATION OF JENDL-2 WAS PERFORMED ON THE BASIS OF THE DATA
    MEASURED BY OHKUBO ET AL./3/ AMONG 138 LEVELS MEASURED IN THE
    ENERGY REGION UP TO 18.6 KEV, 116 RESONANCE LEVELS WERE
    ASSUMED TO BE S-WAVE, AND REMAINING 22 LEVELS WERE ESTIMATED
    TO BE P-WAVE.  NEUTRON WIDTHS OF ALL LEVELS WERE DETERMINED
    FROM THE 2G*(NEUTRON WIDTH) MEASURED BY OHKUBO ET AL.
    HOWEVER, THE VALUE OF TOTAL SPIN J FOR EACH RESONANCE LEVEL
    WAS UNKNOWN EXCEPT 13 LEVELS ASSIGNED BY OHKUBO ET AL., AND
    THE TARGET SPIN OF 2.5 WAS ADOPTED AS J FOR J-UNKNOWN LEVELS.
    RADIATION WIDTHS WERE OBTAINED FOR 10 LEVELS BELOW 2.6 KEV
    FROM THE MEASUREMENT BY OHKUBO ET AL.  AVERAGE RADIATION WIDTH
    WAS ALSO ESTIMATED TO BE 328+-18 MEV BY OHKUBO ET AL., AND WAS
    ADOPTED FOR THE OTHER LEVELS.  A NEGATIVE RESONANCE WAS ADDED
    AT -943 EV SO AS TO REPRODUCE THE THERMAL CAPTURE CROSS
    SECTION OF 480+-10 MB GIVEN BY MUGHABGHAB ET AL./4/

    FOR JENDL-3, THE TOTAL SPIN J OF 125 RESONANCE LEVELS WAS
    TENTATIVELY ESTIMATED WITH A RANDOM NUMBER METHOD.  NEUTRON
    WIDTHS OF THESE LEVELS WERE MODIFIED ON THE BASIS OF THE
    ESTIMATED J VALUES.  NEUTRON AND RADIATION WIDTHS OF THE
    NEGATIVE RESONANCE LEVEL WERE ALSO MODIFIED SO AS TO REPRODUCE
    THE THERMAL CAPTURE CROSS SECTION ACCORDING TO THE ABOVE
    MODIFICATION OF THE NEUTRON WIDTHS.  SCATTERING RADIUS WAS
    TAKEN FROM THE GRAPH (FIG. 1, PART A) GIVEN BY MUGHABGHAB ET
    AL.

  UNRESOLVED RESONANCE REGION : 8.468 KEV - 100 KEV
    UNRESOLVED RESONANCE PARAMETERS WERE ADOPTED FROM JENDL-2.
    THE NEUTRON STRENGTH FUNCTION, S0, WAS TAKEN FROM THE
    RECOMMENDATION IN REF./5/, AND S1 AND S2 WERE CALCULATED WITH
    OPTICAL MODEL CODE CASTHY/6/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 1.000E-4, S1 = 2.920E-4, S2 = 0.650E-4, SG = 21.4E-4,
    GG = 0.205 EV, R  = 6.828 FM.


  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S                 RES. INTEG.
      TOTAL           6.334                      -
      ELASTIC         5.854                      -
      CAPTURE         0.4800                      8.73

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/7/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING R0, RS AND RSO OF IIJIMA-KAWAI POTENTIAL/8/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/9/
     ALPHA    = HUIZENGA AND IGO/10/
     DEUTERON = LOHR AND HAEBERLI/11/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/12/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/13/ WERE EVALUATED BY IIJIMA ET AL./14/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /15/.
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  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./16/.

             NO.      ENERGY(MEV)    SPIN-PARITY
             GR.       0.0            5/2 -
              1        0.1513         3/2 -
              2        0.2810         1/2 -
              3        0.5140         9/2 +
              4        0.7350         3/2 -
              5        0.8685         7/2 -
              6        0.8830         1/2 -
              7        0.9500         5/2 +
              8        1.1750         7/2 +
      LEVELS ABOVE 1.294 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/17/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (22.0E-04) WAS ADJUSTED TO
    REPRODUCE THE CAPTURE CROSS SECTION OF 335 MILLI-BARNS AT 25
    KEV MEASURED BY LAKSHMANA ET AL./18/

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT = 32  (N,N'D) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =106  (N,HE3) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (= 281.4) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/19/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,2N), (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,2N)      1050.00  MB (RECOMMENDED BY BYCHKOV+/20/)
      (N,P)         17.40  MB (SYSTEMATICS OF FORREST/21/)
      (N,ALPHA)      6.65  MB (RECOMMENDED BY FORREST/21/)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
         ----------------------  ------------  ---------------
        V  = 46.0-0.25E          R0 = 5.7      A0 = 0.62
        WS = 7.0                 RS = 6.2      AS = 0.35
        VSO= 7.0                 RSO= 5.7      ASO= 0.62
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2  LEVEL DENSITY PARAMETERS

 NUCLIDE   SYST A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
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35-BR- 81		1.290E+01	8.310E-01	3.275E+00	7.733E+00	1.570E+00
35-BR- 82		1.266E+01	6.900E-01	5.789E+00	3.665E+00	0.0
35-BR- 83		1.324E+01	7.830E-01	2.683E+00	6.978E+00	1.460E+00
35-BR- 84	*	1.302E+01	7.738E-01	1.393E+01	5.216E+00	0.0
36-KR- 82		1.319E+01	7.810E-01	4.961E-01	8.191E+00	2.740E+00
36-KR- 83		1.483E+01	6.700E-01	2.532E+00	5.589E+00	1.170E+00
36-KR- 84		9.970E+00	9.600E-01	4.942E-01	8.590E+00	2.630E+00
36-KR- 85		1.024E+01	8.900E-01	1.570E+00	6.261E+00	1.170E+00
37-RB- 83	*	1.400E+01	7.831E-01	3.730E+00	7.579E+00	1.570E+00
37-RB- 84		1.106E+01	8.060E-01	5.598E+00	4.438E+00	0.0
37-RB- 85		1.190E+01	8.690E-01	2.827E+00	7.561E+00	1.460E+00
37-RB- 86		1.002E+01	8.500E-01	3.954E+00	4.312E+00	0.0

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 4.75 FOR RB- 85 AND 5.0 FOR RB- 86.

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MAT number = 3731

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 37-RB- 87 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 12.46 KEV
    RESONANCE PARAMETERS OF JENDL-2 WERE MODIFIED AS FOLLOWS :
    EVALUATION OF JENDL-2 WAS PERFORMED ON THE BASIS OF THE DATA
    MEASURED BY OHKUBO ET AL./3/  AMONG 30 LEVELS MEASURED IN THE
    ENERGY REGION UP TO 49 KEV, 28 LEVELS WERE ASSUMED TO BE
    S-WAVE, AND REMAINING 2 LEVELS AT 267.1 AND 376.9 EV TO BE
    P-WAVE.  NEUTRON WIDTHS WERE DETERMINED FROM THE 2G*(NEUTRON
    WIDTH) MEASURED BY OHKUBO ET AL.  HOWEVER, THE VALUE OF TOTAL
    SPIN J FOR EACH RESONANCE LEVEL WAS UNKNOWN EXCEPT ONLY 6
    LEVELS ASSIGNED BY OHKUBO ET AL.  THE TARGET SPIN OF 1.5 WAS
    ADOPTED FOR THESE UNKNOWN LEVELS INSTEAD OF J.  RADIATION
    WIDTH WAS OBTAINED TO BE 166+-8 MEV FOR ONLY ONE RESONANCE
    LEVEL AT 376.9 EV FROM THE MEASUREMENT BY OHKUBO ET AL.
    AVERAGE RADIATION WIDTH WAS ALSO ESTIMATED TO BE 166+-30 MEV
    BY OHKUBO ET AL., AND WAS ADOPTED FOR THE OTHER LEVELS.

    FOR JENDL-3, THE TOTAL SPIN J OF 24 RESONANCE LEVELS WAS
    TENTATIVELY ESTIMATED WITH A RANDOM NUMBER METHOD.  NEUTRON
    WIDTHS OF THESE LEVELS WERE MODIFIED ON THE BASIS OF THE
    ESTIMATED J-VALUES.  RADIATION WIDTH OF THE 2ND LEVEL AT 376.9
    EV AND AVERAGE RADIATION WIDTH WERE ALSO MODIFIED TO 115.33
    AND 115.0 MEV, RESPECTIVELY, SO AS TO REPRODUCE THE THERMAL
    CAPTURE CROSS SECTION OF 120+-30 MB GIVEN BY MUGHABGHAB ET
    AL./4/  SCATTERING RADIUS WAS TAKEN FROM THE GRAPH (FIG. 1,
    PART A) GIVEN BY MUGHABGHAB ET AL.

  UNRESOLVED RESONANCE REGION : 12.46 KEV - 100 KEV
    UNRESOLVED RESONANCE PARAMETERS WERE ADOPTED FROM JENDL-2.
    THE NEUTRON STRENGTH FUNCTION, S0, WAS TAKEN FROM THE
    RECOMMENDATION IN REF./5/, AND S1 AND S2 WERE CALCULATED WITH
    OPTICAL MODEL CODE CASTHY/6/.  THE OBSERVED LEVEL SPACING WERE
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH GG WAS BASED ON THE COMPILATION OF BNL-325
    (3RD ED.)/5/.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 1.600E-4, S1 = 2.920E-4, S2 = 0.650E-4, SG = 0.987E-4,
    GG = 0.290 EV, R  = 6.423 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           4.479                   -
      ELASTIC         4.359                   -
      CAPTURE         0.1200                   2.72

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/7/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING R0, RS AND RSO OF IIJIMA-KAWAI POTENTIAL/8/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/9/
     ALPHA    = HUIZENGA AND IGO/10/
     DEUTERON = LOHR AND HAEBERLI/11/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/12/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/13/ WERE EVALUATED BY IIJIMA ET AL./14/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /15/.

  MT = 1  TOTAL
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    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./16/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             3/2 -
            1        0.4030          5/2 -
            2        0.8458          1/2 -
            3        1.4630          3/2 -
            4        1.5785          9/2 +
            5        1.7410          5/2 -
            6        2.4150          7/2 +
            7        2.5560          5/2 +
      LEVELS ABOVE 2.811 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/17/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (1.125E-04) WAS ADJUSTED TO
    REPRODUCE THE CAPTURE CROSS SECTION OF 30 MILLI-BARNS AT 25
    KEV MEASURED BY KONONOV ET AL./18/ FINALLY, THE CROSS SECTION
    WAS MODIFIED BY MULTIPLYING AN ENERGY-DEPENDENT FACTOR SO AS
    TO REPRODUCE THE EXPERIMENTAL DATA /19,20/ IN THE ENERGY
    RANGE FROM 100 KEV TO 10 MEV.

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT = 32  (N,N'D) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (= 322.2) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/21/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,2N), (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,2N)       1300.00  MB (RECOMMENDED BY BYCHKOV+/22/)
      (N,P)          11.80  MB (RECOMMENDED BY FORREST/23/)
      (N,ALPHA)       3.80  MB (RECOMMENDED BY FORREST)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING FROM OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
         ----------------------   ------------  ---------------
       V  = 46.0-0.25E            R0 = 5.7      A0 = 0.62
       WS = 7.0                   RS = 6.2      AS = 0.35
       VSO= 7.0                   RSO= 5.7      ASO= 0.62
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2  LEVEL DENSITY PARAMETERS

 NUCLIDE  SYST A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
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35-BR- 83		1.324E+01	7.830E-01	2.683E+00	6.978E+00	1.460E+00
35-BR- 84	*	1.302E+01	7.738E-01	1.393E+01	5.216E+00	0.0
35-BR- 85		1.100E+01	7.000E-01	7.248E-01	3.841E+00	9.300E-01
35-BR- 86	*	9.718E+00	7.558E-01	1.999E+00	2.830E+00	0.0
36-KR- 84		9.970E+00	9.600E-01	4.942E-01	8.590E+00	2.630E+00
36-KR- 85		1.024E+01	8.900E-01	1.570E+00	6.261E+00	1.170E+00
36-KR- 86		9.052E+00	8.686E-01	2.185E-01	5.874E+00	2.100E+00
36-KR- 87		9.400E+00	8.860E-01	8.826E-01	5.481E+00	1.170E+00
37-RB- 85		1.190E+01	8.690E-01	2.827E+00	7.561E+00	1.460E+00
37-RB- 86		1.002E+01	8.500E-01	3.954E+00	4.312E+00	0.0
37-RB- 87		8.806E+00	9.410E-01	1.125E+00	5.465E+00	9.300E-01
37-RB- 88		9.801E+00	8.185E-01	2.880E+00	3.704E+00	0.0

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 5.214 FOR RB- 87 AND 5.0 FOR RB- 88.

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MAT number = 3831
 38-SR- 86 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 37.12 KEV
    THE RESOLVED RESONANCE PARAMETERS FOR JENDL-3 WERE TAKEN FROM
    JENDL-2 WHICH WAS EVALUATED ON THE BASIS OF THE MEASURED DATA
    BY CAMARDA ET AL./3/ AND MUSGROVE ET AL./4/  THOSE OF THE
    FIRST RESONANCE LEVEL AT 588.4 EV WERE ADJUSTED SO AS TO
    REPRODUCE THE CAPTURE CROSS SECTION OF 1.04+-0.07 BARNS AT
    0.0253 EV AND ITS RESONANCE INTEGRAL OF 4.79+-0.24 BARNS GIVEN
    BY MUGHABGHAB ET AL./5/  SCATTERING RADIUS WAS ALSO MODIFIED
    TO 7.25 FM ON THE BASIS OF THE GRAPH (FIG.1, PART A) OF
    REF./5/

  UNRESOLVED RESONANCE REGION : 37.12 KEV - 100 KEV
    UNRESOLVED RESONANCE PARAMETERS WERE ADOPTED FROM JENDL-2.
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/6/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.740E-4, S1 = 3.500E-4, S2 = 0.360E-4, SG = 1.23E-4,
    GG = 0.324 EV, R  = 7.436 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S                RES. INTEG.
      TOTAL           5.173                     -
      ELASTIC         4.133                     -
      CAPTURE         1.040                      4.82

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/7/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED BY IIJIMA AND KAWAI/8/ TO REPRODUCE A SYSTEMATIC
  TREND OF THE TOTAL CROSS SECTION.  THE OMP'S FOR CHARGED
  PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/9/
     ALPHA    = HUIZENGA AND IGO/10/
     DEUTERON = LOHR AND HAEBERLI/11/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/12/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/13/ WERE EVALUATED BY IIJIMA ET AL./14/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /15/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./16/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             0  +
            1        1.0786          2  +
            2        1.8542          2  +
            3        2.2297          4  +
            4        2.4819          3  -
            5        2.6423          2  -
            6        2.6728          5  -
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            7        2.7880           2  +
            8        2.8569           6  +
            9        2.8783           3  +
           10        2.9555           8  +
           11        2.9973           3  -
           12        3.0557           5  -
           13        3.1852           3  -
      LEVELS ABOVE 3.291 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/17/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (1.13E-04) WAS ADJUSTED TO
    REPRODUCE THE CAPTURE CROSS SECTION OF 35 MILLI-BARNS AT 100
    KEV MEASURED BY MUSGROVE ET AL./4/

  MT = 16  (N,2N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
  MT =111  (N,2P) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE
    PEGASUS.

    THE KALBACH'S CONSTANT K (= 268.2) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/18/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,P)          44.00  MB (RECOMMENDED BY FORREST/19/)
      (N,ALPHA)      10.30  MB (SYSTEMATICS OF FORREST/19/)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                 DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
         ----------------------   ------------  ---------------
        V  = 46.0-0.25E           R0 = 5.893    A0 = 0.62
        WS = 7.0                  RS = 6.393    AS = 0.35
        VSO= 7.0                  RSO= 5.893    ASO= 0.62
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2  LEVEL DENSITY PARAMETERS

 NUCLIDE  SYST A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
 ---------------------------------------------------------------
 36-KR- 82      1.319E+01 7.810E-01 4.961E-01 8.191E+00 2.740E+00
 36-KR- 83      1.483E+01 6.700E-01 2.532E+00 5.589E+00 1.170E+00
 36-KR- 84      9.970E+00 9.600E-01 4.942E-01 8.590E+00 2.630E+00
 36-KR- 85      1.024E+01 8.900E-01 1.570E+00 6.261E+00 1.170E+00

 37-RB- 83   *  1.400E+01 7.831E-01 3.730E+00 7.579E+00 1.570E+00
 37-RB- 84      1.106E+01 8.060E-01 5.598E+00 4.438E+00 0.0
 37-RB- 85      1.190E+01 8.690E-01 2.827E+00 7.561E+00 1.460E+00
 37-RB- 86      1.002E+01 8.500E-01 3.954E+00 4.312E+00 0.0

 38-SR- 84   *  1.417E+01 7.738E-01 7.392E-01 8.748E+00 2.810E+00
 38-SR- 85      1.134E+01 9.100E-01 3.646E+00 7.608E+00 1.240E+00
 38-SR- 86      1.120E+01 8.900E-01 5.328E-01 8.599E+00 2.700E+00
 38-SR- 87      1.030E+01 8.610E-01 1.186E+00 5.938E+00 1.240E+00
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SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 1.035 FOR SR- 86 AND 6.928 FOR SR- 87.

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MAT number = 3834

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 38-SR- 87 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 14.08 KEV
    RESONANCE PARAMETERS OF JENDL-2 WERE MODIFIED AS FOLLOWS:
    EVALUATION OF JENDL-2 WAS PERFORMED ON THE BASIS OF THE
    MEASUREMENTS BY CAMARDA ET AL./3/ AND MUSGROVE ET AL./4/
    NEUTRON WIDTHS WERE DERIVED FROM THE DATA OF 2G*(NEUTRON
    WIDTH) AND NEUTRON CAPTURE AREAS.  NEUTRON ORBITAL ANGULAR
    MOMENTUM L WAS ASSUMED TO BE 0 FOR ALL RESONANCE LEVELS EXCEPT
    THE 2ND LEVEL (L=1) AT 35.27 EV.  HOWEVER, THE VALUES OF TOTAL
    SPIN J WERE UNKNOWN FOR ALL RESONANCE LEVELS.  THUS, TARGET
    SPIN OF 4.5 WAS ADOPTED AS J VALUE.  AVERAGE RADIATION WIDTH
    OF 180.4 MEV WAS OBTAINED BY AVERAGING THE GIVEN RADIATION
    WIDTHS.  HOWEVER, THIS VALUE WAS REDUCED TO 110.72 MEV SO AS
    TO REPRODUCE THE NEUTRON CAPTURE RESONANCE INTEGRAL OF 118+-30
    BARNS GIVEN BY MUGHABGHAB ET AL./5/  A NEGATIVE RESONANCE WAS
    ALSO ADDED AT -50 EV, AND THE PARAMETERS WERE ADJUSTED SO AS
    TO REPRODUCE THE THERMAL CAPTURE CROSS SECTION OF 16+-3 BARNS
    GIVEN BY MUGHABGHAB ET AL.

    FOR JENDL-3, THE VALUES OF TOTAL SPIN J WERE TENTATIVELY
    ESTIMATED WITH A RANDOM NUMBER METHOD.  NEUTRON WIDTHS WERE
    MODIFIED ON THE BASIS OF THE ESTIMATED J-VALUES.  RADIATION
    WIDTH OF THE NEGATIVE LEVEL WAS SLIGHTLY ADJUSTED SO AS TO
    REPRODUCE THE THERMAL CAPTURE CROSS SECTION ACCORDING TO THE
    MODIFICATION OF THE POSITIVE LEVELS.  SCATTERING RADIUS WAS
    TAKEN FROM THE GRAPH (FIG. 1, PART A) GIVEN BY MUGHABGHAB ET
    AL.

  UNRESOLVED RESONANCE REGION : 14.08 KEV - 100 KEV
    UNRESOLVED RESONANCE PARAMETERS WERE ADOPTED FROM JENDL-2.
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/6/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.300E-4, S1 = 4.000E-4, S2 = 0.360E-4, SG = 4.72E-4,
    GG = 0.116 EV, R  = 7.414 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL          22.90                    -
      ELASTIC         6.897                   -
      CAPTURE        16.00                  121

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/7/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED BY IIJIMA AND KAWAI/8/ TO REPRODUCE A SYSTEMATIC
  TREND OF THE TOTAL CROSS SECTION.  THE OMP'S FOR CHARGED
  PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/9/
     ALPHA    = HUIZENGA AND IGO/10/
     DEUTERON = LOHR AND HAEBERLI/11/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/12/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/13/ WERE EVALUATED BY IIJIMA ET AL./14/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /15/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.
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MT = 2 ELASTIC SCATTERING
CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

MT = 4, 51 - 91 INELASTIC SCATTERING
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS ADOPTED. THE LEVEL SCHEME WAS TAKEN FROM REF./16/.

NO.	ENERGY(MEV)	SPIN-PARITY
GR.	0.0	9/2 +
1	0.3883	1/2 +
2	0.8730	3/2 -
3	1.2290	5/2 +
4	1.2570	5/2 -
5	1.7390	13/2 +
6	1.7710	5/2 +
7	1.9210	7/2 +

LEVELS ABOVE 1.997 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/17/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (4.71E-04) WAS ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION OF 42 MILLI-BARNS AT 70 KEV MEASURED BY MUSGROVE ET AL./4/

MT = 16 (N,2N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT = 32 (N,N'D) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =106 (N,HE3) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 394.6) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/18/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,P)	20.60 MB	(SYSTEMATICS OF FORREST/19/)
(N,ALPHA)	6.81 MB	(SYSTEMATICS OF FORREST)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 46.0-0.25E	R0 = 5.893	A0 = 0.62
WS = 7.0	RS = 6.393	AS = 0.35
VSO= 7.0	RSO= 5.893	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
36-KR- 83	1.483E+01	6.700E-01	2.532E+00	5.589E+00	1.170E+00
36-KR- 84	9.970E+00	9.600E-01	4.942E-01	8.590E+00	2.630E+00
36-KR- 85	1.024E+01	8.900E-01	1.570E+00	6.261E+00	1.170E+00
36-KR- 86	9.052E+00	8.686E-01	2.185E-01	5.874E+00	2.100E+00

37-RB- 84	1.106E+01	8.060E-01	5.598E+00	4.438E+00	0.0
37-RB- 85	1.190E+01	8.690E-01	2.827E+00	7.561E+00	1.460E+00
37-RB- 86	1.002E+01	8.500E-01	3.954E+00	4.312E+00	0.0
37-RB- 87	8.806E+00	9.410E-01	1.125E+00	5.465E+00	9.300E-01
38-SR- 85	1.134E+01	9.100E-01	3.646E+00	7.608E+00	1.240E+00
38-SR- 86	1.120E+01	8.900E-01	5.328E-01	8.599E+00	2.700E+00
38-SR- 87	1.030E+01	8.610E-01	1.186E+00	5.938E+00	1.240E+00
38-SR- 88	9.160E+00	7.510E-01	8.288E-02	4.550E+00	2.170E+00

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 6.928 FOR SR- 87 AND 5.839 FOR SR- 88.

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MAT number = 3837
 38-SR- 88 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-SEP90 REV2-OCT93
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.
93-10 JENDL-3.2 WAS MADE BY JNDC FPND W.G.

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)       RESOLVED RESONANCE PARAMETERS
     ***********************************************************


MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 300 KEV
      RESOLVED RESONANCE PARAMETERS FOR JENDL-3 WERE TAKEN FROM
    JENDL-2 WHICH WAS EVALUATED ON THE BASIS OF THE MEASUREMENTS
    BILPUCH ET AL./3/, CAMARDA ET AL./4/, MALAN ET AL./5/ AND
    BOLDEMAN ET AL./6/.
      FOR JENDL-3, RADIATION WIDTHS OF THE 1ST AND 5TH RESONANCE
    LEVELS (L=0) AT 2.78 AND 13.8 KEV WERE MODIFIED TO 190 AND 106
    MEV, RESPECTIVELY, SO AS TO REPRODUCE THE THERMAL CAPTURE
    CROSS SECTION OF 5.8+-0.4 MB GIVEN BY ROY ET AL./7/ SCATTERING
    RADIUS OF 7.1 FM WAS TAKEN FROM MUGHABGHAB ET AL./8/
      FOR JENDL-3.2, THESE RESONANCE PARAMETERS WERE MODIFIED SO
    AS TO REPRODUCE THE CAPTURE AREA DATA MEASURED AT ORNL, BY
    TAKING ACCOUNT OF THE CORRECTION FACTOR (1.0737) ANNOUNCED BY
    ALLEN ET AL./9/

  NO UNRESOLVED RESONANCE REGION

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           5.436                   -
      ELASTIC         5.431                   -
      CAPTURE         0.0058                   0.0633

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 300 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 300 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY/10/, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/11/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED BY IIJIMA AND KAWAI/12/ TO REPRODUCE A SYSTEMATIC
  TREND OF THE TOTAL CROSS SECTION.  THE OMP'S FOR CHARGED
  PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/13/
     ALPHA    = HUIZENGA AND IGO/14/
     DEUTERON = LOHR AND HAEBERLI/15/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/16/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/17/ WERE EVALUATED BY IIJIMA ET AL./18/   MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /19/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./20/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             0  +
            1        1.8360          2  +
            2        2.7341          3  -
            3        3.1510          0  +
            4        3.2185          2  +
            5        3.4865          1  +
            6        3.5239          2  +
            7        3.5846          5  -
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          8        3.6344          3  +
          9        3.9526          4  +
         10        3.9900          3  -
         11        4.0355          2  +
         12        4.1701          4  -
         13        4.2240          3  +
         14        4.2320          4  +
         15        4.2693          3  -
         16        4.2980          4  +
         17        4.4137          3  +
         18        4.4520          4  +
         19        4.4840          0  +
         20        4.5139          2  -
         21        4.6190          2  +
     LEVELS ABOVE 4.636 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/21/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (0.0375E-04) WAS ADJUSTED TO
    REPRODUCE THE CAPTURE CROSS SECTION OF 2.8 MILLI-BARNS AT 100
    KEV MEASURED BY MUSGROVE ET AL./22,9/

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (= 380.2) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/23/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,P)          15.00  MB (RECOMMENDED BY FORREST/24/)
      (N,ALPHA)       4.45  MB (SYSTEMATICS OF FORREST/24/)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
         ----------------------  ------------  ---------------
        V  = 46.0-0.25E          R0 = 5.893    A0 = 0.62
        WS = 7.0                 RS = 6.393    AS = 0.35
        VSO= 7.0                 RSO= 5.893    ASO= 0.62
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2  LEVEL DENSITY PARAMETERS

 NUCLIDE       A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
 -----------------------------------------------------------------
 36-KR- 84     9.970E+00 9.600E-01 4.942E-01 8.590E+00 2.630E+00
 36-KR- 85     1.024E+01 8.900E-01 1.570E+00 6.261E+00 1.170E+00
 36-KR- 86     9.052E+00 8.686E-01 2.185E-01 5.874E+00 2.100E+00
 36-KR- 87     9.400E+00 8.860E-01 8.826E-01 5.481E+00 1.170E+00

 37-RB- 85     1.190E+01 8.690E-01 2.827E+00 7.561E+00 1.460E+00
 37-RB- 86     1.002E+01 8.500E-01 3.954E+00 4.312E+00 0.0
 37-RB- 87     8.806E+00 9.410E-01 1.125E+00 5.465E+00 9.300E-01
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37-RB- 88	9.801E+00	8.185E-01	2.880E+00	3.704E+00	0.0
38-SR- 86	1.120E+01	8.900E-01	5.328E-01	8.599E+00	2.700E+00
38-SR- 87	1.030E+01	8.610E-01	1.186E+00	5.938E+00	1.240E+00
38-SR- 88	9.160E+00	7.510E-01	8.288E-02	4.550E+00	2.170E+00
38-SR- 89	9.380E+00	8.200E-01	5.043E-01	4.642E+00	1.240E+00

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 5.839 FOR SR- 88 AND 5.818 FOR SR- 89.

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MAT number = 3840

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 38-SR- 89 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  NO RESOLVED RESONANCE PARAMETERS

  UNRESOLVED RESONANCE REGION : 1.4 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0 AND S2 WERE CALCULATED WITH
    OPTICAL MODEL CODE CASTHY/2/, AND S1 WAS BASED ON THE
    SYSTEMATICS OF MUGHABGHAB ET AL./3/.  THE OBSERVED LEVEL
    SPACING WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.  THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS
    OF MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.370E-4, S1 = 4.800E-4, S2 = 0.400E-4, SG = 0.551E-4,
    GG = 0.170 EV, R  = 7.047 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           6.120                   -
      ELASTIC         5.700                   -
      CAPTURE         0.4200                    0.414

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 1.4 KEV, THE CAPTURE AND ELASTIC SCATTERING CROSS SECTIONS
  WERE ASSUMED TO BE IN 1/V FORM AND CONSTANT, RESPECTIVELY.  THE
  CAPTURE CROSS SECTION AT 0.0253 EV WAS TAKEN FROM REF./3/, AND
  THE SCATTERING CROSS SECTION WAS ESTIMATED BY ASSUMING R = 6.7
  FM.  UNRESOLVED RESONANCE PARAMETERS WERE GIVEN IN THE ENERGY
  RANGE FROM 1.4 KEV TO 100 KEV.

  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/4/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED BY IIJIMA AND KAWAI/5/ TO REPRODUCE A SYSTEMATIC
  TREND OF THE TOTAL CROSS SECTION.  THE OMP'S FOR CHARGED
  PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/6/
     ALPHA    = HUIZENGA AND IGO/7/
     DEUTERON = LOHR AND HAEBERLI/8/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/9/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/10/ WERE EVALUATED BY IIJIMA ET AL./11/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /12/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/13/ AND NUCLEAR DATA
    SHEETS/14/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0            5/2 +
            1        1.0320         1/2 +
            2        1.4734         7/2 +
            3        1.9402         5/2 +
            4        2.0076         3/2 +
            5        2.0574         3/2 -
            6        2.0613         9/2 +
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           7         2.0790          11/2 -
           8         2.2801           5/2 +
           9         2.4516           3/2 +
          10         2.5701           3/2 -
          11         2.6710           7/2 +
      LEVELS ABOVE 2.707 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/15/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (0.616E-04) WAS DETERMINED
    FROM THE SYSTEMATICS OF RADIATION WIDTH (0.17 EV) AND THE
    AVERAGE S-WAVE RESONANCE LEVEL SPACING (2760 EV) CALCULATED
    FROM THE LEVEL DENSITY PARAMETERS.

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT = 32  (N,N'D) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (= 330.4) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/16/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,P)          8.85  MB (SYSTEMATICS OF FORREST/17/)
      (N,ALPHA)      2.86  MB (SYSTEMATICS OF FORREST)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
         ----------------------  ------------  ---------------
        V  = 46.0-0.25E           R0 = 5.893    A0 = 0.62
        WS = 7.0                  RS = 6.393    AS = 0.35
        VSO= 7.0                  RSO= 5.893    ASO= 0.62
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2  LEVEL DENSITY PARAMETERS

 NUCLIDE  SYST A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
 ---------------------------------------------------------------
 36-KR- 85      1.024E+01 8.900E-01 1.570E+00 6.261E+00 1.170E+00
 36-KR- 86      9.052E+00 8.686E-01 2.185E-01 5.874E+00 2.100E+00
 36-KR- 87      9.400E+00 8.860E-01 8.826E-01 5.481E+00 1.170E+00
 36-KR- 88   *  1.074E+01 7.386E-01 2.319E-01 5.156E+00 1.890E+00

 37-RB- 86      1.002E+01 8.500E-01 3.954E+00 4.312E+00 0.0
 37-RB- 87      8.806E+00 9.410E-01 1.125E+00 5.465E+00 9.300E-01
 37-RB- 88      9.801E+00 8.185E-01 2.880E+00 3.704E+00 0.0
 37-RB- 89   *  1.086E+01 7.303E-01 1.126E+00 3.949E+00 7.200E-01

 38-SR- 87      1.030E+01 8.610E-01 1.186E+00 5.938E+00 1.240E+00
 38-SR- 88      9.160E+00 7.510E-01 8.288E-02 4.550E+00 2.170E+00
 38-SR- 89      9.380E+00 8.200E-01 5.043E-01 4.642E+00 1.240E+00
 38-SR- 90      9.940E+00 8.530E-01 3.795E-01 6.252E+00 1.960E+00
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SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 5.818 FOR SR- 89 AND 4.524 FOR SR- 90.

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MAT number = 3843

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 38-SR- 90 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-SEP90 REV2-AUG93
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.
93-08 JENDL-3.2 WAS MADE BY JNDC FPND W.G.

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (3,1), (3,102)        BELOW 6 KEV
     ***********************************************************


MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  NO RESOLVED RESONANCE PARAMETERS

  UNRESOLVED RESONANCE REGION : 6.0 KEV - 100 KEV
    UNRESOLVED RESONANCE PARAMETERS WERE ADOPTED FROM JENDL-2.
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/3/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULA-
    TED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.370E-4, S1 = 5.420E-4, S2 = 0.360E-4, SG = 0.190E-4,
    GG = 0.205 EV, R  = 6.796 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           5.8187                  -
      ELASTIC         5.8037                  -
      CAPTURE         0.0150                   0.0901

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 6.0 KEV, THE CAPTURE AND ELASTIC SCATTERING CROSS SECTIONS
  WERE ASSUMED TO BE IN 1/V FORM AND CONSTANT, RESPECTIVELY.  THE
  CAPTURE CROSS SECTION AT 0.0253 EV WAS TAKEN FROM REF./4/ AND
  THE ELASTIC SCATTERING CROSS SECTION WAS ESTIMATED BY ASSUMING R
  = 6.796 FM.  UNRESOLVED RESONANCE PARAMETERS WERE GIVEN IN THE
  ENERGY RANGE FROM 6.0 KEV TO 100 KEV.  THE TOTAL CROSS SECTION
  IS SUM OF THESE TWO CROSS SECTIONS.

  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/5/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED BY IIJIMA AND KAWAI/6/ TO REPRODUCE A SYSTEMATIC
  TREND OF THE TOTAL CROSS SECTION.  THE OMP'S FOR CHARGED
  PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/7/
     ALPHA    = HUIZENGA AND IGO/8/
     DEUTERON = LOHR AND HAEBERLI/9/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/10/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/11/ WERE EVALUATED BY IIJIMA ET AL./12/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /13/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./14/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             0  +
            1        0.8317          2  +
            2        1.6559          4  +
            3        1.8923          2  +
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          4        2.2070           2  +
          5        2.4973           2  +
      LEVELS ABOVE 2.528 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/15/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (1.70E-05) WAS DETERMINED FROM
    THE SYSTEMATICS OF RADIATION WIDTH (0.205 EV) AND AVERAGE
    S-WAVE RESONANCE LEVEL SPACING (12 KEV).

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT = 32  (N,N'D) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE
    PEGASUS.

    THE KALBACH'S CONSTANT K (= 259.0) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/16/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,P)           5.79  MB (SYSTEMATICS OF FORREST/17/)
      (N,ALPHA)       1.82  MB (SYSTEMATICS OF FORREST)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
          ----------------------  ------------  ---------------
         V  = 46.0-0.25E          R0 = 5.893    A0 = 0.62
         WS = 7.0                 RS = 6.393    AS = 0.35
         VSO= 7.0                 RSO= 5.893    ASO= 0.62
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2  LEVEL DENSITY PARAMETERS

 NUCLIDE  SYST  A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
 ---------------------------------------------------------------
 36-KR- 86      9.052E+00 8.686E-01 2.185E-01 5.874E+00 2.100E+00
 36-KR- 87      9.400E+00 8.860E-01 8.826E-01 5.481E+00 1.170E+00
 36-KR- 88   *  1.074E+01 7.386E-01 2.319E-01 5.156E+00 1.890E+00
 36-KR- 89   *  1.166E+01 7.303E-01 9.153E-01 4.874E+00 1.170E+00

 37-RB- 87      8.806E+00 9.410E-01 1.125E+00 5.465E+00 9.300E-01
 37-RB- 88      9.801E+00 8.185E-01 2.880E+00 3.704E+00 0.0
 37-RB- 89   *  1.086E+01 7.303E-01 1.126E+00 3.949E+00 7.200E-01
 37-RB- 90      1.179E+01 7.220E-01 4.570E+00 3.659E+00 0.0

 38-SR- 88      9.160E+00 7.510E-01 8.288E-02 4.550E+00 2.170E+00
 38-SR- 89      9.380E+00 8.200E-01 5.043E-01 4.642E+00 1.240E+00
 38-SR- 90      9.940E+00 8.530E-01 3.795E-01 6.252E+00 1.960E+00
 38-SR- 91      1.090E+01 8.100E-01 1.103E+00 5.625E+00 1.240E+00
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  SYST:  * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

 SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
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IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 4.524 FOR SR- 90 AND 5.0 FOR SR- 91.

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MAT number = 3925
 39-Y - 89 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-SEP90 REV2-NOV93
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.
93-11 JENDL-3.2 WAS MADE BY JNDC FPND W.G.

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)       RESOLVED RESONANCE PARAMETERS
     ***********************************************************


MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 48 KEV
    RESONANCE PARAMETERS WERE TAKEN FROM JENDL-2 AFTER SLIGHT
    MODIFICATION.
       FOR JENDL-2, RESONANCE ENERGIES WERE TAKEN FROM BOLDEMAN ET
    AL./3/ FOR THE LEVELS BELOW 47 KEV AND CAMARDA ET AL./4/ FOR
    THOSE ABOVE 50 KEV.  FOR THE NEUTRON WIDTHS, ADOPTED WERE
    AVERAGE VALUES OF MORGENSTERN ET AL./5/, BOLDEMAN ET AL. AND
    CAMARDA ET AL.  THE RADIATION WIDTHS WERE DERIVED FROM CAPTURE
    AREAS MEASURED BY BOLDEMAN ET AL.
       AVERAGE RADIATION WIDTH = 0.123 +- 0.027 EV FOR S-WAVE RES.
                                 0.279 +- 0.127 EV FOR P-WAVE RES.
    THE SCATTERING RADIUS OF 6.7 FM WAS TAKEN FROM REF./6/.
       FOR JENDL-3, ONLY TOTAL SPIN J AND ANGULAR MOMENTUM L OF
    SOME RESONANCES WERE ESTIMATED WITH A RANDOM NUMBER METHOD AND
    A METHOD OF BOLLINGER AND THOMAS/7/, RESPECTIVELY.  A NEGATIVE
    RESONANCE AT -251 EV WAS ADDED SO AS TO REPRODUCE THE THERMAL
    CAPTURE AND SCATTERING CROSS SECTIONS GIVEN BY MUGHABGHAB ET
    AL./6/
       FOR JENDL-3.2, THE PARAMETERS FOR LEVELS MEASURED BY
    BOLDEMAN ET AL. IN THE ENERGY RANGE UP TO 46.07 KEV WERE
    REEVALUATED USING THEIR CAPTURE AREAS MULTIPLIED BY A FACTOR
    OF 1.036 ACCORDING TO A CORRIGENDUM REPORTED BY ALLEN ET
    AT./8/

  UNRESOLVED RESONANCE REGION : 48 KEV - 100 KEV
    UNRESOLVED RESONANCE PARAMETERS WERE ADOPTED FROM JENDL-2.
    THE NEUTRON STRENGTH FUNCTIONS, S0 AND S1 WERE ADOPTED FROM
    THE RECOMMENDATION IN REF./9/, AND WAS CALCULATED WITH
    OPTICAL MODEL CODE CASTHY/10/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.320E-4, S1 = 4.400E-4, S2 = 0.360E-4, SG = 0.626E-4,
    GG = 0.132 EV, R  = 7.235 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           8.9900                  -
      ELASTIC         7.7127                  -
      CAPTURE         1.2773                   0.870

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/11/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED BY IIJIMA AND KAWAI/12/ TO REPRODUCE A SYSTEMATIC
  TREND OF THE TOTAL CROSS SECTION.  THE OMP'S FOR CHARGED
  PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/13/
     ALPHA    = HUIZENGA AND IGO/14/
     DEUTERON = LOHR AND HAEBERLI/15/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/16/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/17/ WERE EVALUATED BY IIJIMA ET AL./18/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /19/.
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```
  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./20/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.        0.0             1/2 -
            1         0.9091          9/2 +
            2         1.5074          3/2 -
            3         1.7445          5/2 -
            4         2.2210          5/2 +
            5         2.5299          7/2 +
            6         2.5664         11/2 +
            7         2.6222          9/2 +
            8         2.8710          7/2 +
            9         2.8820          3/2 -
           10         3.0680          3/2 -
           11         3.1060          5/2 -
           12         3.1380          5/2 -
      LEVELS ABOVE 3.502 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/21/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (5.95E-05) WAS ADJUSTED TO
    REPRODUCE THE CAPTURE CROSS SECTION OF 13 MILLI-BARNS AT 70
    KEV MEASURED BY MUSGROVE ET AL./22,8/

  MT = 16  (N,2N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT = 32  (N,N'D) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =106  (N,HE3) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (= 299.5) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/23/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,2N), (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,2N)       980.00  MB (RECOMMENDED BY  BYCHKOV+/24/)
      (N,P)         25.00  MB (RECOMMENDED BY  FORREST/25/)
      (N,ALPHA)      5.50  MB (RECOMMENDED BY  FORREST)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
         ----------------------   ------------  ---------------
       V  = 46.0-0.25E            R0 = 5.893    A0 = 0.62
       WS = 7.0                   RS = 6.393    AS = 0.35
       VSO= 7.0                   RSO= 5.893    ASO= 0.62
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.
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TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
37-RB- 85		1.190E+01	8.690E-01	2.827E+00	7.561E+00	1.460E+00
37-RB- 86		1.002E+01	8.500E-01	3.954E+00	4.312E+00	0.0
37-RB- 87		8.806E+00	9.410E-01	1.125E+00	5.465E+00	9.300E-01
37-RB- 88		9.801E+00	8.185E-01	2.880E+00	3.704E+00	0.0
38-SR- 86		1.120E+01	8.900E-01	5.328E-01	8.599E+00	2.700E+00
38-SR- 87		1.030E+01	8.610E-01	1.186E+00	5.938E+00	1.240E+00
38-SR- 88		9.160E+00	7.510E-01	8.288E-02	4.550E+00	2.170E+00
38-SR- 89		9.380E+00	8.200E-01	5.043E-01	4.642E+00	1.240E+00
39-Y - 87	*	1.388E+01	7.471E-01	2.541E+00	6.730E+00	1.460E+00
39-Y - 88		1.109E+01	7.450E-01	3.738E+00	3.570E+00	0.0
39-Y - 89		7.900E+00	8.500E-01	3.983E-01	3.440E+00	9.300E-01
39-Y - 90		1.027E+01	6.770E-01	1.716E+00	2.209E+00	0.0

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 6.916 FOR Y - 89 AND 5.0 FOR Y - 90.

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MAT number = 3931
 39-Y - 91 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  NO RESOLVED RESONANCE PARAMETERS

  UNRESOLVED RESONANCE REGION : 380 EV - 100 KEV
    THE NEUTRON STRENGTH FUNCTION S1 WAS BASED ON THE SYSTEMATICS
    OF MUGHABGHAB ET AL./2/, AND S0 AND S2 WERE CALCULATED WITH
    OPTICAL MODEL CODE CASTHY/3/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS OF
    MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.370E-4, S1 = 5.500E-4, S2 = 0.390E-4, SG = 2.81E-4,
    GG = 0.210 EV, R  = 6.747 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                   2200 M/S               RES. INTEG.
      TOTAL          7.100                   -
      ELASTIC        5.700                   -
      CAPTURE        1.400                    2.85

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 380 EV, THE CAPTURE AND ELASTIC SCATTERING CROSS SECTIONS
  WERE ASSUMED TO BE IN 1/V FORM AND CONSTANT, RESPECTIVELY.  THE
  CAPTURE CROSS SECTION AT 0.0253 EV WAS ADOPTED FROM REF./2/ AND
  THE SCATTERING CROSS SECTION WAS CALCULATED FROM R = 6.7 FM.
  UNRESOLVED RESONANCE PARAMETERS WERE GIVEN IN THE ENERGY RANGE
  FROM 380 EV TO 100 KEV.

  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/4/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED BY IIJIMA AND KAWAI/5/ TO REPRODUCE A SYSTEMATIC
  TREND OF THE TOTAL CROSS SECTION.  THE OMP'S FOR CHARGED
  PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/6/
     ALPHA    = HUIZENGA AND IGO/7/
     DEUTERON = LOHR AND HAEBERLI/8/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/9/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/10/ WERE EVALUATED BY IIJIMA ET AL./11/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /12/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/13/ AND NUCLEAR DATA
    SHEETS/14/.

             NO.      ENERGY(MEV)    SPIN-PARITY
             GR.       0.0             1/2 -
              1        0.5556          9/2 +
              2        0.6530          3/2 -
              3        0.9258          5/2 -
              4        1.1869          7/2 -
              5        1.3054          5/2 +
              6        1.4737          3/2 -
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           7         1.5459          5/2 -
           8         1.5480          7/2 -
           9         1.5799          5/2 +
          10         1.9804          3/2 -
          11         2.0666          5/2 +
          12         2.1291          3/2 +
          13         2.1630          3/2 -
          14         2.2067          5/2 -
          15         2.2794          5/2 +
          16         2.4122          3/2 -
          17         2.4740          3/2 -
          18         2.5300          5/2 -
          19         2.5700          1/2 -
          20         2.5721          5/2 +
          21         2.6890          7/2 -
          22         2.7800          9/2 +
          23         2.9600          3/2 -
          24         2.9800          1/2 -
          25         3.0450          1/2 -
          26         3.1000          9/2 -
          27         3.1960          7/2 -
          28         3.2270          9/2 +
          29         3.2840          7/2 -
     LEVELS ABOVE 3.32 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/15/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (2.74E-04) WAS DETERMINED FROM
    THE SYSTEMATICS OF RADIATION WIDTH (0.21 EV) AND THE AVERAGE
    S-WAVE RESONANCE LEVEL SPACING (769 EV) CALCULATED FROM THE
    LEVEL DENSITY PARAMETERS.

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT = 32  (N,N'D) CROSS SECTION
  MT = 33  (N,N'T) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (= 334.4) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/16/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,P)          10.70  MB (SYSTEMATICS OF FORREST/17/)
      (N,ALPHA)       3.31  MB (SYSTEMATICS OF FORREST)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
          ----------------------  ------------  ---------------
        V  = 46.0-0.25E           R0 = 5.893    A0 = 0.62
        WS = 7.0                  RS = 6.393    AS = 0.35
        VSO= 7.0                  RSO= 5.893    ASO= 0.62
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.
```

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
37-RB- 87		8.806E+00	9.410E-01	1.125E+00	5.465E+00	9.300E-01
37-RB- 88		9.801E+00	8.185E-01	2.880E+00	3.704E+00	0.0
37-RB- 89	*	1.086E+01	7.303E-01	1.126E+00	3.949E+00	7.200E-01
37-RB- 90		1.179E+01	7.220E-01	4.570E+00	3.659E+00	0.0
38-SR- 88		9.160E+00	7.510E-01	8.288E-02	4.550E+00	2.170E+00
38-SR- 89		9.380E+00	8.200E-01	5.043E-01	4.642E+00	1.240E+00
38-SR- 90		9.940E+00	8.530E-01	3.795E-01	6.252E+00	1.960E+00
38-SR- 91		1.090E+01	8.100E-01	1.103E+00	5.625E+00	1.240E+00
39-Y - 89		7.900E+00	8.500E-01	3.983E-01	3.440E+00	9.300E-01
39-Y - 90		1.027E+01	6.770E-01	1.716E+00	2.209E+00	0.0
39-Y - 91		1.050E+01	7.140E-01	8.362E-01	3.521E+00	7.200E-01
39-Y - 92		1.012E+01	7.629E-01	2.480E+00	3.191E+00	0.0

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 5.103 FOR Y - 91 AND 5.0 FOR Y - 92.

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MAT number = 4000

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 40-ZR-  0 MAPI       EVAL-NOV88 M.SASAKI (MAPI)
                      DIST-SEP89 REV2-APR94
HISTORY
88-11 COMPILED BY T.ASAMI (JAERI)
94-04 JENDL-3.2
        RESONANCE PARAMS OF ZR-90 MODIFIED BY M.KAWAI(TOSHIBA).
        GAMMA-RAY PRODUCTION DATA MODIFIED BY S.IGARASI(NEDAC).
        OTHER MODIFICATIONS WERE ADOPTED FROM JENDL FUSION FILE.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)       RESOLVED RESONANCE PARAMETERS OF ZR-90
      ALL CROSS-SECTION DATA
                    MAINLY TAKEN FROM JENDL FUSION FILE
      (4,16-91)     TAKEN FROM JENDL FUSION FILE
      (5,16-91)     TAKEN FROM JENDL FUSION FILE
      (12,102)
      (13,3), (13,4), (13,103), (13,107)
      (14,4), (14,103), (14,107)
      (15,3), (15,102), (15,103), (15,107)
     ***********************************************************

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      JENDL FUSION FILE /1/  (AS OF APR. 1994)
            EVALUATED AND COMILED BY S.CHIBA (NDC/JAERI)

      -  THE DISCRETE INELASTIC SCATTERING CROSS SECTIONS AND
         THEIR ANGULAR DISTRIBUTIONS WERE CALCULATED WITH CASTHY2Y
         AND DWUCKY IN SINCROS-II SYSTEM/2/ FOR EACH ISOTOPE.
         THE DATA OF NATURAL ZR WAS CONSTRUCTED FROM THESE ISOTOPE
         DATA.
      -  OTHER REACTION CROSS SECTIONS, I.E., THE CONTINUUM
         INELASTIC SCATTERING, (N,2N), (N,3N), (N,NA), (N,NP) AND
         (N,ND) REACTION CROSS SECTIONS AND THEIR SECONDARY
         NEUTRON ENERGY SPECTRA, AND (N,P), (N,D), (N,T), (N,HE3)
         AND (N,A) CROSS SECTIONS WERE CALCULATED BY EGNASH2 IN
         THE SINCROS-II FOR EACH ISOTOPE.  THE DATA FOR NATURAL ZR
         WAS CONSTRUCTED FROM THESE DATA.
      -  THE DDX'S OF THE CONTINUUM NEUTRONS WERE CALCULATED BY
         KUMABE'S SYSTEMATICS /3/ USING F15TOB /1/.  THE
         PRECOMPOUND TO COMPOUND RATIO WAS TAKEN FROM THE EGNASH2
         CALCULATION.
      -  OTHER DATA WERE TAKEN FROM JENDL-3.1.
      -  OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED IN
         THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./2/.
         LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/4/.
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MF=1  GENERAL INFORMATION
 MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
 MT=151  RESONANCE PARAMETERS
   RESOLVED RESONANCE PARAMETERS FOR MLBW FORMULA WERE GIVEN IN
   THE ENERGY REGION FROM 1.0E-5 EV TO 171 KEV.  UPPER BOUNDARIES
   OF THE RESOLVED RESONANCE REGIONS ARE:
       ZR-90: 171.0 KEV            ZR-91: 30.16 KEV
       ZR-92:  71.0 KEV            ZR-94: 53.5  KEV
       ZR-96: 100.0 KEV
   UNRESOLVED RESONANCE PARAMETERS WERE GIVEN UP TO 100 KEV FOR
   ZR-91, -92, -94.  THE PARAMETERS WERE DETERMINED TO REPRODUCE
   EVALUATED CAPTURE AND TOTAL CROSS SECTIONS.  DESCRIPTION ON
   EVALUATION IS GIVEN IN THE (1,451) OF EACH ISOTOPE.  THE
   ABUNDANCE DATA WERE TAKEN FROM REF./5/ TO BE 0.5145, 0.1122,
   0.1715, 0.1738 AND 0.0280 FOR ZR-90, -91, -92, -94 AND -96,
   RESPECTIVELY.

            2200 M/S CROSS SECTION(B)     RES. INTEGRAL(B)
    TOTAL            6.6026
    ELASTIC          6.4084
    CAPTURE          0.1943                       1.203

MF=3  NEUTRON CROSS SECTIONS
   BELOW 100 KEV, NO BACKGROUND CROSS SECTION WAS GIVEN.  BETWEEN
   100 AND 171 KEV, CONTRIBUTIONS FROM ZR-91, 92, 94 AND 96 WERE
   GIVEN AS BACKGROUND CROSS SECTIONS TO TOTAL, ELASTIC AND
   CAPTURE.

     FOR JENDL-3.2, THE ALL CROSS SECTION DATA EXCEPT FOR THE
   TOTAL WERE ADOPTED FROM JENDL FUSION FILE.  THE CALCULATION WAS
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MADE WITH SINCROS-II SYSTEM/2/ BY ADOPTING WALTER-GUSS OMP MODIFIED BY YAMAMURO/2/ FOR NEUTRONS, LEMOS OMP MODIFIED BY ARTHUR AND YOUNG/6/ FOR ALPHA, THE SAME OMP'S AS THE PEGASUS CALCULATION FOR OTHER CHARGED PARTICLES AND STANDARD LEVEL DENSITY PARAMETERS OF SINCROS-II SYSTEM.

Q-VALUES OF THRESHOLD REACTIONS INCLUDING INELASTIC SCATTERING WERE SLIGHTLY CHANGED FROM CORRECT VALUES TO CONSISTENT ONES WITH THRESHOLD ENERGIES AND ATOMIC WEIGHT OF NATURAL ZR.

MT=1 TOTAL
MANY EXPERIMENTAL DATA ARE EXISTING. EVALUATED BASED ON THE EXPERIMENTAL DATA.

MT=2 ELASTIC SCATTERING
OBTAINED BY SUBTRACTING THE SUM OF THE PARTIAL CROSS SECTIONS FROM THE TOTAL CROSS SECTION.

MT=4, 51-89, 91 INELASTIC SCATTERING
TAKEN FROM JENDL FUSION FILE. THE LEVEL SCHEME WAS TAKEN FROM REF./4/. THE DATA FOR SOME LEVELS WERE LUMPED AS FOLLOWS:

MT	LEVEL ENERGY(MEV)	ZR-90	ZR-91	ZR-92	ZR-94	ZR-96
G.S.	0.0					
51	0.918				51	
52	0.934			51		
53	1.205		51			
54	1.300				52	
55	1.383			52		
56	1.466		52		53	
57	1.495			53		
58	1.593					51
59	1.671				54	
60	1.750					52
61	1.761	51				
62	1.847			54		
63	1.882		53			53
64	2.042		54		55	
65	2.067			55		53
66	2.131		55			
67	2.150			56	56	
68	2.170		56			
69	2.187	52	57			
70	2.201		58			
71	2.225					54
72	2.260		59			
73	2.288		60			
74	2.319	53	61			
75	2.329			57	57	55
76	2.356		62,63		58	
77	2.395		64	58		
78	2.439					56
79	2.486			59		
80	2.507				59	
81	2.604				60	
82	2.698				61	
83	2.739	54,55		60		
84	2.819			61,62	62-64	57
85	2.903			63,64		
86	2.958			65		
87	3.039			66,67		
88	3.078	56				
89	3.309	57				
91	2.395	91	91	91	91	91

MT=16, 22, 28, 103 AND 107 (N,2N), (N,NA), (N,NP), (N,P) AND (N,A)
CONSTRUCTED FROM THE STATISTICAL-MODEL CALCULATIONS FOR EACH ISOTOPE.

MT=102 CAPTURE
CONSTRUCTED FROM THE DATA OF EACH ISOTOPE, THEN MODIFIED BY MULTIPLING AN ENERGY DEPENDENT FACTOR TO REPRODUCE THE EXPERIMENTAL DATA OF STAVISSKIJ ET AL./7/ AND POENITZ /8/.

MT=251 MU-BAR
CALCULATED WITH OPTICAL MODEL.

MF=4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=2 ELASTIC SCATTERING
CONSTRUCTED FROM THE STATISTICAL-MODEL/9/ CALCULATIONS FOR EACH ISOTOPE.

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 MT=51-89    INELASTIC SCATTERING
    TAKEN FROM JENDL FUSION FILE.  CONSTRUCTED FROM THE DATA FOR
    EACH ISOTOPE.
 MT=16, 22, 28, 91
    TAKEN FROM JENDL FUSION FILE.  DDX DATA IN MF6 WERE
    APPROXIMATELY TRANSFORMED TO MF4 AND MF5.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=16, 22, 28, 91
    TAKEN FROM JENDL FUSION FILE.  DDX DATA IN MF6 WERE
    APPROXIMATELY TRANSFORMED TO MF4 AND MF5.

MF=12  PHOTON PRODUCTION MULTIPLICITIES
 MT=102
    FROM ENERGY BALANCE.

MF=13  PHOTON PRODUCTION CROSS SECTIONS
 MT=3  (ABOVE 2 MEV)
    CONSTRUCTED FROM THE DATA FOR 5 ISOTOPES, USING MULTIPLICITIES
    CALCULATED WITH EGNASH /2/ AND CROSS SECTIONS.
 MT=4  (BELOW 2 MEV)
    CONSTRUCTED FROM LEVEL EXCITATION CROSS SECTIONS OF ISOTOPES
    AND TRANSITION PROBABILITIES TAKEN FROM ENSDF.
 MT=103, 107 (BELOW 2 MEV)
    MADE FROM THE DATA FOR ISOTOPES CALCULATED WITH EGNASH.

MF=14  PHOTON ANGULAR DISTRIBUTIONS
 MT=3, 4, 102, 103, 107
    ASSUMED TO BE ISOTROPIC IN THE LABORATORY SYSTEM.

MF=15  CONTINUOUS PHOTON ENERGY SPECTRA
 MF=3 (ABOVE 2 MEV)
    CALCULATED WITH EGNASH.
 MT=102
    SPECTRA WERE CALCULATED WITH CASTHY FOR 5 ISOTOPES, REFERRING
    TO THE COMPILATION OF GAMMA-RAY SPECTRA FOR THERMAL NEUTRON BY
    LONE ET AL. /10/ , AT 1.0E-5, 2.53E-2, 1.0, 1.0E+2, 1.0E+3,
    1.0E+5, 5.0E+5, 1.0E+6, 1.5E+6 AND 2.0E+6 EV.  PRIMARY
    TRANSITIONS WERE TAKEN INTO ACCOUNT FOR ZR-90, ZR-91 AND
    ZR-94.
 MF=103, 107 (BELOW 2 MEV)
    CALCULATED WITH EGNASH.
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MAT number = 4025

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 40-ZR- 90 JNDC       EVAL-AUG89 JNDC FP NUCLEAR DATA W.G.
                      DIST-SEP90 REV2-NOV93
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
89-08 MODIFICATION FOR JENDL-3 WAS MADE/2/.
90-10 MF=5: SPECTRA AT THRESHOLD ENERGIES WERE MODIFIED.
93-11 JENDL-3.2.
        RESONANCE PARAMETERS MODIFIED BY M.KAWAI(TOSHIBA).
        OTHER MODIFICATIONS WERE ADOPTED FROM JENDL FUSION FILE.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)       RESOLVED RESONANCE PARAMETERS
      (3,2), (3,4), (3,32), (3,51-57), (3,91)
                    TAKEN FROM JENDL FUSION FILE
         (3,58-64): DELETED.
      (4,16-91)     TAKEN FROM JENDL FUSION FILE
      (5,16-91)     TAKEN FROM JENDL FUSION FILE
     ***********************************************************

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      JENDL FUSION FILE /3/  (AS OF NOV. 1993)
            EVALUATED AND COMILED BY S. CHIBA (NDC/JAERI)

      DATA WERE TAKEN FROM JENDL-3.1 EXCEPT FOR THE FOLLOWING:
      -  THE DISCRETE AND CONTINUUM INELASTIC SCATTERING CROSS
         SECTIONS WERE CALCULATED WITH CASTHY2Y AND DWUCKY IN
         SINCROS-II SYSTEM/4/ INCLUDING CONTRIBUTIONS FROM
         DIRECT REACTIONS.
      -  ANGULAR DISTRIBUTIONS OF DISCRETE INELASTICS WERE ALSO
         CALCULATED WITH CASTHY2Y AND DWUCKY.
      -  THE (N,ND) REACTION CROSS SECTION (MT=32) WAS NEWLY
         CALCULATED BY EGNASH2 IN THE SINCROS-II.
      -  ALL ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE
         REPLACED BY THOSE CALCULATED BY EGNASH2.  THE DDX'S OF
         THE CONTINUUM NEUTRONS WERE CALCULATED BY KUMABE'S
         SYSTEMATICS /5/ USING F15TOB /3/.  THE PRECOMPOUND TO
         COMPOUND RATIO WAS CALCULATED BY THE SINCROS-II CODE
         SYSTEM.
      -  OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED IN
         THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./4/.
         LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/6/.
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MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 171 KEV
       RESONANCE PARAMETERS FOR JENDL-3.1 WERE TAKEN FROM JENDL-2
    AFTER SLIGHT MODIFICATION.
       FOR JENDL-2, RESONANCE ENERGIES AND NEUTRON WIDTHS WERE
    TAKEN FROM THE DATA OF MUSGROVE ET AL./7/   RADIATION WIDTHS
    WERE DERIVED FROM CAPTURE AREAS MEASURED BY BOLDEMAN ET AL./8/
    THE PARAMETERS OF THE FIRST RESONANCE WERE SLIGHTLY ADJUSTED
    SO AS TO REPRODUCE THE CAPTURE AND AND ELASTIC SCATTERING
    CROSS SECTIONS AT 0.0253 EV/9/.
      AVERAGE RADIATION WIDTH = 0.190 +- 0.110 EV FOR S-WAVE RES,
                                0.270 +- 0.120 EV FOR P-WAVE RES,
                                0.280 +- 0.120 EV FOR D-WAVE RES.
    THE EFFECTIVE SCATTERING RADIUS OF 7.0 FM WAS ASSUMED.
       FOR JENDL-3, THE PARAMETERS OF THREE D-WAVE RESONANCES WERE
    MODIFIED AND A NEGATIVE RESONANCE WAS ADDED SO AS TO REPRODUCE
    THE THERMAL CAPTURE CROSS SECTION OF 0.10+-0.07 BARN MEASURED
    BY POMERANCE/10/, AND THE RESONANCE INTEGRAL GIVEN BY
    MUGHABGHAB ET AL./9/
       FOR JENDL-3.2, THE PARAMETERS FOR THE LEVELS MEASURED BY
    BOLDEMAN ET AL. IN THE ENERGY RANGE UP TO 192.9 KEV WERE
    REEVALUATED USING THEIR CAPTURE AREA DATA MULTIPLIED BY 0.967
    ACCORDING TO A CORRIGENDUM REPORTED BY ALLEN ET AL./11/.  THE
    NEGATIVE RESONANCE WAS REMOVED BECAUSE THE POSITIVE RESONANCE
    PARAMETERS REPRODUCE WELL THE THERMAL CROSS SECTIONS/12/ AND
    RESONANCE INTEGRAL.

  NO UNRESOLVED RESONANCE REGION

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S                RES. INTEG.
      TOTAL           5.376                      -
      ELASTIC         5.365                      -
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     CAPTURE         0.0112                   0.174

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 171 KEV, RESONANCE PARAMETERS WERE GIVEN.

     IN THE EVALUATION FOR JENDL-3.1, ABOVE 171 KEV, THE SPHERICAL
  OPTICAL AND STATISTICAL MODEL CALCULATION WAS PERFORMED WITH
  CASTHY/13/, BY TAKING ACCOUNT OF COMPETING REACTIONS, OF WHICH
  CROSS SECTIONS WERE CALCULATED WITH PEGASUS/14/ STANDING ON A
  PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL.  THE OMP'S FOR
  NEUTRON GIVEN IN TABLE 1 WERE DETERMINED BY IIJIMA AND KAWAI/15/
  TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS SECTION.  THE
  OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/16/
     ALPHA    = HUIZENGA AND IGO/17/
     DEUTERON = LOHR AND HAEBERLI/18/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/19/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/20/ WERE EVALUATED BY IIJIMA ET AL./21/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /22/.

     FOR JENDL-3.2, DATA OF INELASTIC SCATTERING AND (N,ND) REAC-
  TION CROSS SECTIONS WERE ADOPTED FROM JENDL FUSION FILE.  THE
  CALCULATION WAS MADE WITH SINCROS-II SYSTEM/4/ BY ADOPTING
  WALTER-GUSS OMP MODIFIED BY YAMAMURO/4/ FOR NEUTRONS, LEMOS
  OMP MODIFIED BY ARTHUR AND YOUNG/23/ FOR ALPHA, THE SAME OMP'S
  AS THE PEGASUS CALCULATION FOR OTHER CHARGED PARTICLES AND
  STANDARD LEVEL DENSITY PARAMETERS OF SINCROS-II SYSTEM.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    TAKEN FROM JENDL FUSION FILE.  THE LEVEL SCHEME WAS TAKEN FROM
    REF./6/  CONTRIBUTIONS OF THE DIRECT PROCESS WAS CALCULATED
    FOR THE LEVELS MARKED WITH '*'.

           NO.      ENERGY(MEV)    SPIN-PARITY (DIRECT PROCESS)
           GR.        0.0             0  +
            1         1.7607          0  +          *
            2         2.1865          2  +          *
            3         2.3191          5  -
            4         2.7388          4  -
            5         2.7479          3  -          *
            6         3.0772          4  +          *
            7         3.3087          2  +
     LEVELS ABOVE 3.309 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/24/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (1.41E-05) WAS ADJUSTED TO
    REPRODUCE THE CAPTURE CROSS SECTION OF 7.5 MILLI-BARNS AT 100
    KEV MEASURED BY MUSGROVE ET AL./25/

  MT = 16  (N,2N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =106  (N,HE3) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
  MT =111  (N,2P) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (= 301.6) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/26/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
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NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
(N,P)   40.00 MB (RECOMMENDED BY FORREST/27/)
(N,ALPHA)   10.00 MB (RECOMMENDED BY FORREST)

THE (N.2N) CROSS SECTION WAS DETERMINED BY EYE-GUIDING TO THE EXPERIMENTAL DATA OF ZHAO WEN-RONG ET AL./28/, PAVLINK ET AL. /29/ AND MANY MEASURED DATA AROUND 14.5 MEV.

MT = 32 (N,N'D) CROSS SECTION
TAKEN FROM JENDL FUSION FILE.

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
MT = 2
CALCULATED WITH CASTHY/13/.
MT = 51-57
TAKEN FROM JENDL FUSION FILE WHICH WAS CALCULATED WITH CASTHY AND DWUCK/30/ (DWUCKY) IN THE SINCROS-II SYSTEM.
MT = 16,17,22,28,32,91
TRANSFORMED FROM MF=6 DATA (DDX) OF JENDL FUSION FILE.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
MT = 16,17,22,28,32,91
TRANSFORMED FROM MF=6 DATA (DDX) OF JENDL FUSION FILE.

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<<FOLLOWING ARE PARAMETERS USED IN THE CASTHY AND PEGASUS CALC.>>

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TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 46.0-0.25E	R0 = 5.893	A0 = 0.62
WS = 7.0	RS = 6.393	AS = 0.35
VSO= 7.0	RSO= 5.893	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
38-SR- 86		1.120E+01	8.900E-01	5.328E-01	8.599E+00	2.700E+00
38-SR- 87		1.030E+01	8.610E-01	1.186E+00	5.938E+00	1.240E+00
38-SR- 88		9.160E+00	7.510E-01	8.288E-02	4.550E+00	2.170E+00
38-SR- 89		9.380E+00	8.200E-01	5.043E-01	4.642E+00	1.240E+00
39-Y - 87	*	1.388E+01	7.471E-01	2.541E+00	6.730E+00	1.460E+00
39-Y - 88		1.109E+01	7.450E-01	3.738E+00	3.570E+00	0.0
39-Y - 89		7.900E+00	8.500E-01	3.983E-01	3.440E+00	9.300E-01
39-Y - 90		1.027E+01	6.770E-01	1.716E+00	2.209E+00	0.0
40-ZR- 88	*	1.404E+01	7.386E-01	4.932E-01	7.870E+00	2.660E+00
40-ZR- 89		1.095E+01	8.260E-01	1.379E+00	5.864E+00	1.200E+00
40-ZR- 90		9.152E+00	8.222E-01	1.526E-01	5.383E+00	2.130E+00
40-ZR- 91		1.036E+01	8.000E-01	7.822E-01	5.057E+00	1.200E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 10.12 FOR ZR- 90 AND 12.04 FOR ZR- 91.

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MAT number = 4028
 40-ZR- 91 JNDC       EVAL-AUG89 JNDC FP NUCLEAR DATA W.G.
                      DIST-OCT89 REV2-SEP93
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
89-08 MODIFICATION FOR JENDL-3 WAS MADE/2/.
90-10 MF=5: SPECTRA AT THRESHOLD ENERGIES WERE MODIFIED.
93-09 JENDL-3.2.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      ALMOST ALL CROSS SECTION DATA EXCEPT (3,1), (3,102),
      (3,103) AND (3,107):
          (3,4), (3,51-91), (3,16), (3,17), (3,22), (3,28),
          (3,32), (3,104), (3,105), (3,106)
      (4,16-91)
      (5,16-91)
             THESE DATA WERE TAKEN FROM JENDL FUSION FILE.
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      JENDL FUSION FILE /3/  (AS OF SEP. 1993)
            EVALUATED AND COMILED BY S. CHIBA (NDC/JAERI)

      DATA WERE TAKEN FROM JENDL-3.1 EXCEPT FOR THE FOLLOWING:
      -  THE DISCRETE AND CONTINUUM INELASTIC SCATTERING CROSS
         SECTIONS WERE CALCULATED WITH CASTHY2Y AND DWUCKY IN
         SINCROS-II SYSTEM/4/ INCLUDING CONTRIBUTIONS FROM
         DIRECT REACTIONS.
      -  ANGULAR DISTRIBUTIONS OF DISCRETE INELASTICS WERE ALSO
         CALCULATED WITH CASTHY2Y AND DWUCKY.
      -  THRESHOLD REACTION CROSS SECTIONS (MT=16, 17, 22, 28, 32,
         104, 105 AND 106) WERE REPLACED WITH THOSE CALCULATED BY
         EGNASH2 IN THE SINCROS-II.
      -  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE REPLACED
         BY THOSE CALCULATED BY EGNASH2.  THE DDX'S OF THE CONTI-
         NUUM NEUTRONS WERE CALCULATED BY KUMABE'S SYSTEMATICS/5/
         USING F15TOB /3/.  THE PRECOMPOUND/COMPOUND RATIO WAS
         CALCULATED BY THE SINCROS- II CODE SYSTEM.
      -  OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED IN
         THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./4/.
         LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/6/.
     -------------------------------------------------------------


MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 30.16 KEV
    FOR JENDL-2, RESONANCE ENERGIES RECOMMENDED BY MUGHABGHAB ET
    AL. /7/ WERE ADOPTED.  NEUTRON AND RADIATIVE CAPTURE WIDTHS
    WERE OBTAINED BY AVERAGING THE DATA OF MUSGROVE ET AL. /8/
    AND OF BRUSEGAN ET AL. /9/.  FOR THE LEVELS ABOVE 20 KEV,
    CAPTURE AREAS BY BOLDEMAN ET AL. /10/ WERE ALSO TAKEN INTO
    ACCOUNT.  PARAMETERS OF A NEGATIVE RESONANCE WERE ADOPTED
    FROM REF./7/.  THE EFFECTIVE SCATTERING RADIUS WAS ALSO TAKEN
    FROM REF./7/.
      ASSUMED CAPTURE WIDTH = 0.120 EV FOR S-WAVE RES.
                              0.240 EV FOR P-WAVE RES.
    FOR JENDL-3, THUS EVALUATED PARAMETERS WERE MODIFIED BY TAKING
    ACCOUNT OF THE EVALUATION BY COCEVA/11/.  AFTER MODIFICATION,
    RADIATIVE WIDTHS WERE DETERMINED SO AS TO REPRODUCE CAPTURE
    AREAS OF JENDL-2.
  UNRESOLVED RESONANCE REGION : 30.16 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/12/.  THE OBSERVED LEVEL
    SPACING WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION
    AT 100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.420E-4, S1 = 5.700E-4, S2 = 0.360E-4, GG = 0.205 EV
    D0 = 660.4 EV, R  = 6.621 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                    2200 M/S               RES. INTEG.
      TOTAL         11.83                    -
      ELASTIC       10.59                    -
      CAPTURE        1.247                    6.95
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MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY/12/, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/13/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED BY IIJIMA AND KAWAI/14/ TO REPRODUCE A SYSTEMATIC
  TREND OF THE TOTAL CROSS SECTION.  THE OMP'S FOR CHARGED
  PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/15/
     ALPHA    = HUIZENGA AND IGO/16/
     DEUTERON = LOHR AND HAEBERLI/17/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/18/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GIRBERT
  AND CAMERON/19/ WERE EVALUATED BY IIJIMA ET AL./20/.  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /21/.

     FOR JENDL-3.2, DATA OF NEUTRON EMITTING REACTIONS WERE
  ADOPTED FROM JENDL FUSION FILE.  THE CALCULATION WAS MADE WITH
  SINCROS-II SYSTEM/4/ BY ADOPTING WALTER-GUSS OMP MODIFIED BY
  YAMAMURO/4/ FOR NEUTRONS, LEMOS OMP MODIFIED BY ARTHUR AND
  YOUNG/22/ FOR ALPHA, THE SAME OMP'S AS THE PEGASUS CALCULATION
  FOR OTHER CHARGED PARTICLES AND STANDARD LEVEL DENSITY PARAME-
  TERS OF SINCROS-II SYSTEM.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    TAKEN FROM JENDL FUSION FILE.  THE LEVEL SCHEME WAS TAKEN FROM
    REF./6/  CONTRIBUTIONS OF THE DIRECT PROCESS WAS CALCULATED
    FOR THE LEVELS MARKED WITH '*'.

           NO.       ENERGY(MEV)    SPIN-PARITY (DIRECT PROCESS)
           GR.        0.0             5/2 +
            1         1.2048          1/2 +
            2         1.4663          5/2 +           *
            3         1.8821          7/2 +           *
            4         2.0422          3/2 +           *
            5         2.1313          9/2 +           *
            6         2.1700         11/2 -
            7         2.1899          5/2 +
            8         2.2007          7/2 +
            9         2.2597         13/2 -
           10         2.2876         15/2 -
           11         2.3201         11/2 -           *
           12         2.3558          1/2 -           *
           13         2.3669          7/2 -           *
           14         2.3949          9/2 -           *
      LEVELS ABOVE 2.395 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT = 32  (N,N'D) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =106  (N,HE3) CROSS SECTION
    DATA WERE ADOPTED FROM JENDL FUSION FILE.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY/12/ WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/23/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (3.199E-04) WAS ADJUSTED TO
    REPRODUCE THE CAPTURE CROSS SECTION OF 25 MILLI-BARNS AT 100
    KEV MEASURED BY MUSGROVE ET AL./24/

  MT =103  (N,P) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
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    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE
    PEGASUS/13/.

    THE KALBACH'S CONSTANT K (=269.1) WAS ESTIMATED BY THE FORMULA
    DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/25/ AND LEVEL DENSITY
    PARAMETERS.

    FINALLY, (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO
    THE FOLLOWING VALUES AT 14.5 MEV:
      (N,P)          29.00  MB (RECOMMENDATION BY FORREST/26/)
      (N,ALPHA)       8.51  MB (SYSTEMATICS OF BY FORREST/26/)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY/12/.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT = 2
    CALCULATED WITH CASTHY/12/.
  MT = 51-54
    TAKEN FROM JENDL FUSION FILE DATA WHICH WAS CALCULATED WITH
    CASTHY AND DWUCK/27/ (DWUCKY) IN THE SINCROS-II SYSTEM.
  MT = 16,17,22,28,32,91
    TRANSFORMED FROM MF=6 DATA (DDX) OF JENDL FUSION FILE.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT = 16,17,22,28,32,91
    TRANSFORMED FROM MF=6 DATA (DDX) OF JENDL FUSION FILE.


=================================================================
<<FOLLOWING ARE PARAMETERS USED IN THE CASTHY AND PEGASUS CALC.>>
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TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                 DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
         ----------------------   ------------  ---------------
         V  = 46.0-0.25E           R0 = 5.893    A0 = 0.62
         WS = 7.0                  RS = 6.393    AS = 0.35
         WSO= 7.0                  RSO= 5.893    ASO= 0.62

TABLE 2  LEVEL DENSITY PARAMETERS

 NUCLIDE       A(/MEV)   T(MEV)    C(/MEV)   EX(MEV)   PAIRING
 ---------------------------------------------------------------
 38-SR- 87     1.030E+01 8.610E-01 1.186E+00 5.938E+00 1.240E+00
 38-SR- 88     9.160E+00 7.510E-01 8.288E-02 4.550E+00 2.170E+00
 38-SR- 89     9.380E+00 8.200E-01 5.043E-01 4.642E+00 1.240E+00
 38-SR- 90     9.940E+00 8.530E-01 3.795E-01 6.252E+00 1.960E+00

 39-Y - 88     1.109E+01 7.450E-01 3.738E+00 3.570E+00 0.0
 39-Y - 89     7.900E+00 8.500E-01 3.983E-01 3.440E+00 9.300E-01
 39-Y - 90     1.027E+01 6.770E-01 1.716E+00 2.209E+00 0.0
 39-Y - 91     1.050E+01 7.140E-01 8.362E-01 3.521E+00 7.200E-01

 40-ZR- 89     1.095E+01 8.260E-01 1.379E+00 5.864E+00 1.200E+00
 40-ZR- 90     9.152E+00 8.222E-01 1.526E-01 5.383E+00 2.130E+00
 40-ZR- 91     1.036E+01 8.000E-01 7.822E-01 5.057E+00 1.200E+00
 40-ZR- 92     1.088E+01 8.192E-01 5.122E-01 6.429E+00 1.920E+00
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  SPIN CUTOFF PARAMS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
  IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
  ASSUMED TO BE 12.04 FOR ZR- 91 AND 6.937 FOR ZR- 92.

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MAT number = 4031

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 40-ZR- 92 JNDC       EVAL-AUG89 JNDC FP NUCLEAR DATA W.G.
                      DIST-SEP90 REV2-APR94
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
89-08 MODIFICATION FOR JENDL-3 WAS MADE/2/.
90-10 MF=5: SPECTRA AT THRESHOLD ENERGIES WERE MODIFIED.
94-04 JENDL-3.2.
       RESONANCE PARAMETERS BY M.KAWAI(TOSHIBA)
       OTHERS WERE MAINLY TAKEN FROM JENDL FUSION FILE
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (3,2), (3,4), (3,51-91), (3,16), (3,17)
      (4,16-91)
      (5,16-91)
             ABOVE DATA WERE TAKEN FROM JENDL FUSION FILE.
      (2,151)    PARAMETERS OF A NEGATIVE RESONANCE
     **********************************************************

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      JENDL FUSION FILE /3/  (AS OF APR. 1994)
            EVALUATED AND COMILED BY S. CHIBA (NDC/JAERI)

      DATA WERE TAKEN FROM JENDL-3.1 EXCEPT FOR THE FOLLOWING:
      -  THE DISCRETE AND CONTINUUM INELASTIC SCATTERING CROSS
         SECTIONS WERE CALCULATED WITH CASTHY2Y AND DWUCKY IN
         SINCROS-II SYSTEM/4/ INCLUDING CONTRIBUTIONS FROM
         DIRECT REACTIONS.
      -  ANGULAR DISTRIBUTIONS OF DISCRETE INELASTICS WERE ALSO
         CALCULATED WITH CASTHY2Y AND DWUCKY.
      -  THRESHOLD REACTION CROSS SECTIONS (MT=16, 17) WERE
         REPLACED WITH THOSE CALCULATED BY EGNASH2 IN THE
         SINCROS-II.
      -  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE REPLACED
         BY THOSE CALCULATED BY EGNASH2 EXCEPT FOR MT=32 AND 33.
         THE DDX'S OF THE CONTINUUM NEUTRONS WERE CALCULATED BY
         KUMABE'S SYSTEMATICS /5/ USING F15TOB /3/.  THE
         PRECOMPOUND/COMPOUND RATIO WAS CALCULATED BY THE SINCROS-
         II CODE SYSTEM.
      -  OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED IN
         THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./4/.
         LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/6/.
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MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 71 KEV
    RESONANCE PARAMETERS WERE TAKEN FROM JENDL-2.  EVALUATION FOR
    JENDL-2 WAS BASED ON THE MEASURED DATA BY BOLDEMAN ET AL./7/
    PARAMETERS OF A NEGATIVE RESONANCE AND EFFECTIVE SCATTERING
    RADIUS WERE ADOPTED FROM THE RECOMMENDATION OF MUGHABGHAB ET
    AL./8/  AVERAGE RADIATION WIDTHS OF 0.180 EV AND 0.270 WERE
    ASSUMED FOR S-WAVE AND P-WAVE RESONANCES, RESPECTIVELY.  FOR
    JENDL-3.2, THE PARAMETERS OF THE NEGATIVE RESONANCE WERE
    MODIFIED TO REPRODUCE THE THERMAL ELASTIC SCATTERING CROSS
    SECTION OF 7.1 B OF ZR-92 AND 6.4 B/8/ OF NATURAL ZR.

  UNRESOLVED RESONANCE REGION : 71 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS S0 AND S1 WERE BASED ON THE
    COMPILATION OF MUGHABGHAB ET AL., AND S2 WAS CALCULATED WITH
    OPTICAL MODEL CODE CASTHY/9/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTHS GG(S) AND GG(P) WERE BASED ON THE
    COMPILATION OF MUGHABGHAB ET AL.

  TYPICAL VALUES OF THE PARAMETERS AT 80 KEV:
    S0 = 0.500E-4, S1 = 7.000E-4, S2 = 0.380E-4, SG(S)= 0.433E-4,
    SG(P) = 1.11E-4, GG(S)= 0.140EV, GG(P)= 0.360EV, R = 5.964FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                    2200 M/S               RES. INTEG.
      TOTAL          7.339                    -
      ELASTIC        7.110                    -
      CAPTURE        0.2292                    0.714
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MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.

  FOR JENDL-3.1, ABOVE 100 KEV, THE SPHERICAL OPTICAL AND
  STATISTICAL MODEL CALCULATION WAS PERFORMED WITH CASTHY, BY
  TAKING ACCOUNT OF COMPETING REACTIONS, OF WHICH CROSS SECTIONS
  WERE CALCULATED WITH PEGASUS/10/ STANDING ON A PREEQUILIBRIUM
  AND MULTI-STEP EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN
  IN TABLE 1 WERE DETERMINED BY IIJIMA AND KAWAI/11/ TO REPRODUCE
  A SYSTEMATIC TREND OF THE TOTAL CROSS SECTION.  THE OMP'S FOR
  CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/12/
     ALPHA    = HUIZENGA AND IGO/13/
     DEUTERON = LOHR AND HAEBERLI/14/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/15/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/16/ WERE EVALUATED BY IIJIMA ET AL./17/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /18/.

     FOR JENDL-3.2, DATA OF INELASTIC, (N,2N) AND (N,3N) REACTION
  CROSS SECTIONS WERE ADOPTED FROM JENDL FUSION FILE.  THE
  CALCULATION WAS MADE WITH SINCROS-II SYSTEM/4/ BY ADOPTING
  WALTER-GUSS OMP MODIFIED BY YAMAMURO/4/ FOR NEUTRONS, LEMOS OMP
  MODIFIED BY ARTHUR AND YOUNG/19/ FOR ALPHA, THE SAME OMP'S AS
  THE PEGASUS CALCULATION FOR OTHER CHARGED PARTICLES AND STANDARD
  LEVEL DENSITY PARAMETERS OF SINCROS-II SYSTEM.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    TAKEN FROM JENDL FUSION FILE.  THE LEVEL SCHEME WAS TAKEN FROM
    REF./6/  CONTRIBUTIONS OF THE DIRECT PROCESS WAS CALCULATED
    FOR THE LEVELS MARKED WITH '*'.

           NO.      ENERGY(MEV)    SPIN-PARITY (DIRECT PROCESS)
           GR.       0.0             0  +
            1        0.9345          2  +          *
            2        1.3828          0  +          *
            3        1.4954          4  +
            4        1.8473          2  +          *
            5        2.0667          2  +
            6        2.1500          2  +
            7        2.3397          3  -          *
            8        2.3983          4  +
            9        2.4859          5  -
           10        2.7435          4  -
           11        2.8197          2  +          *
           12        2.8640          4  +
           13        2.9036          0  +
           14        2.9095          3  -
           15        2.9578          6  +
           16        3.0397          2  +          *
           17        3.0578          2  +
      LEVELS ABOVE 3.058 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
    TAKEN FROM JENDL FUSION FILE.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/20/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (8.99E-05) WAS ADJUSTED TO
    REPRODUCE THE CAPTURE CROSS SECTION OF 30 MILLI-BARNS AT 100
    KEV MEASURED BY MUSGROVE ET AL./21/

  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT = 32  (N,N'D) CROSS SECTION
  MT = 33  (N,N'T) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
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MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 163.7) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/22/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,P)	22.00 MB	(MEASURED BY IKEDA+/23/)
(N,ALPHA)	9.50 MB	(AVERAGED VALUE OF QAIM+/24/ AND BAYHURST+/25/)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
MT = 2
CALCULATED WITH CASTHY/9/.
MT = 51-67
TAKEN FROM JENDL FUSION FILE WHICH WAS CALCULATED WITH CASTHY AND DWUCK/26/ (DWUCKY) IN THE SINCROS-II SYSTEM.
MT = 16,17,22,28,32,33,91
TRANSFORMED FROM MF=6 DATA (DDX) OF JENDL FUSION FILE.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
MT = 16,17,22,28,91
TRANSFORMED FROM MF=6 DATA (DDX) OF JENDL FUSION FILE.
MT = 32,33
CALCULATED WITH PEGASUS.

<<FOLLOWING ARE PARAMETERS USED IN THE CASTHY AND PEGASUS CALC.>>

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 46.0-0.25E	R0 = 5.893	A0 = 0.62
WS = 7.0	RS = 6.393	AS = 0.35
VSO= 7.0	RSO= 5.893	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
38-SR- 88	9.160E+00	7.510E-01	8.288E-02	4.550E+00	2.170E+00
38-SR- 89	9.380E+00	8.200E-01	5.043E-01	4.642E+00	1.240E+00
38-SR- 90	9.940E+00	8.530E-01	3.795E-01	6.252E+00	1.960E+00
38-SR- 91	1.090E+01	8.100E-01	1.103E+00	5.625E+00	1.240E+00
39-Y - 89	7.900E+00	8.500E-01	3.983E-01	3.440E+00	9.300E-01
39-Y - 90	1.027E+01	6.770E-01	1.716E+00	2.209E+00	0.0
39-Y - 91	1.050E+01	7.140E-01	8.362E-01	3.521E+00	7.200E-01
39-Y - 92	1.012E+01	7.629E-01	2.480E+00	3.191E+00	0.0
40-ZR- 90	9.152E+00	8.222E-01	1.526E-01	5.383E+00	2.130E+00
40-ZR- 91	1.036E+01	8.000E-01	7.822E-01	5.057E+00	1.200E+00
40-ZR- 92	1.088E+01	8.192E-01	5.122E-01	6.429E+00	1.920E+00
40-ZR- 93	1.298E+01	7.000E-01	1.273E+00	5.183E+00	1.200E+00

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 6.937 FOR ZR- 92 AND 6.100 FOR ZR- 93.

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MAT number = 4034

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 40-ZR- 93 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 1.7 KEV
    RESONANCE PARAMETERS WERE NEWLY EVALUATED AS FOLLOWS:
    RESONANCE ENERGIES, NEUTRON WIDTHS AND RADIATION WIDTHS WERE
    MAINLY TAKEN FROM THE MEASUREMENT OF MACKLIN/3/ UP TO 6.1 KEV.
    NEUTRON WIDTHS NOT MEASURED WERE DETERMINED FROM CAPTURE AREA
    DATA, AND TOTAL AND RADIATION WIDTHS OF MACKLIN ET AL./4/
    AVERAGE RADIATION WIDTHS WERE DEDUCED TO BE 0.145 EV FOR
    S-WAVE RESONANCES, AND 0.250 EV FOR P-WAVE RESONANCES.  TOTAL
    SPIN J OF SOME RESONANCES WAS TENTATIVELY ESTIMATED WITH A
    RANDOM NUMBER METHOD.  NEUTRON ORBITAL ANGULAR MOMENTUM L OF
    SOME RESONANCES WAS ESTIMATED WITH A METHOD OF BOLLINGER AND
    THOMAS/5/.  SCATTERING RADIUS WAS BASED ON THE SYSTEMATICS OF
    MEASURED VALUES FOR NEIGHBORING NUCLIDES.  A NEGATIVE
    RESONANCE WAS ADDED SO AS TO REPRODUCE THE THERMAL CAPTURE
    CROSS SECTION GIVEN BY MUGHABGHAB ET AL./6/

  UNRESOLVED RESONANCE REGION : 1.7 KEV - 100 KEV
    UNRESOLVED RESONANCE PARAMETERS WERE ADOPTED FROM JENDL-2.
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/7/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.370E-4, S1 = 5.480E-4, S2 = 0.360E-4, SG = 5.31E-4,
    GG = 0.200 EV, R  = 6.734 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           7.892                   -
      ELASTIC         5.653                   -
      CAPTURE         2.239                 18.2

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/8/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED BY IIJIMA AND KAWAI/9/ TO REPRODUCE A SYSTEMATIC
  TREND OF THE TOTAL CROSS SECTION.  THE OMP'S FOR CHARGED
  PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/10/
     ALPHA    = HUIZENGA AND IGO/11/
     DEUTERON = LOHR AND HAEBERLI/12/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/13/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/14/ WERE EVALUATED BY IIJIMA ET AL./15/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /16/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./17/

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0            5/2 +
            1        0.2671         3/2 +
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              2         0.9490         1/2 +
              3         1.4231         3/2 +
              4         1.4800         7/2 +
              5         1.6000         9/2 +
              6         1.6500         5/2 +
              7         1.9200         1/2 +
              8         2.0400        11/2 -
              9         2.0800         9/2 +
             10         2.1000         1/2 +
        LEVELS ABOVE 2.18 MEV WERE ASSUMED TO BE OVERLAPPING.

   MT = 102  CAPTURE
     SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
     CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
     SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
     AND REFFO/18/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

     THE GAMMA-RAY STRENGTH FUNCTION (5.35E-04) WAS DETERMINED FROM
     THE SYSTEMATICS OF RADIATION WIDTH (0.20 EV) AND THE AVERAGE
     S-WAVE RESONANCE LEVEL SPACING (374 EV) CALCULATED FROM THE
     LEVEL DENSITY PARAMETERS.

   MT = 16  (N,2N) CROSS SECTION
   MT = 17  (N,3N) CROSS SECTION
   MT = 22  (N,N'A) CROSS SECTION
   MT = 28  (N,N'P) CROSS SECTION
   MT = 32  (N,N'D) CROSS SECTION
   MT = 33  (N,N'T) CROSS SECTION
   MT =103  (N,P) CROSS SECTION
   MT =104  (N,D) CROSS SECTION
   MT =105  (N,T) CROSS SECTION
   MT =107  (N,ALPHA) CROSS SECTION
     THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
     PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

     THE KALBACH'S CONSTANT K (= 178.4) WAS ESTIMATED BY THE
     FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/19/ AND LEVEL
     DENSITY PARAMETERS.

     FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
     NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
       (N,P)          12.70  MB (SYSTEMATICS OF FORREST/20/)
       (N,ALPHA)       3.79  MB (SYSTEMATICS OF FORREST)

   MT = 251  MU-BAR
     CALCULATED WITH CASTHY.

 MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
   LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
   GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
   TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
   CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
   BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

 MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
   ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
   PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
   OTHER NEUTRON EMITTING REACTIONS.

 TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
          ----------------------  ------------  ---------------
         V  = 46.0-0.25E          R0 = 5.893    A0 = 0.62
         WS = 7.0                 RS = 6.393    AS = 0.35
         VSO= 7.0                 RSO= 5.893    ASO= 0.62
   THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

 TABLE 2  LEVEL DENSITY PARAMETERS

  NUCLIDE  SYST A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
  ---------------------------------------------------------------
  38-SR- 89     9.380E+00 8.200E-01 5.043E-01 4.642E+00 1.240E+00
  38-SR- 90     9.940E+00 8.530E-01 3.795E-01 6.252E+00 1.960E+00
  38-SR- 91     1.090E+01 8.100E-01 1.103E+00 5.625E+00 1.240E+00
  38-SR- 92   * 1.288E+01 7.065E-01 2.515E-01 6.391E+00 2.360E+00

  39-Y - 90     1.027E+01 6.770E-01 1.716E+00 2.209E+00 0.0
  39-Y - 91     1.050E+01 7.140E-01 8.362E-01 3.521E+00 7.200E-01
  39-Y - 92     1.012E+01 7.629E-01 2.480E+00 3.191E+00 0.0
  39-Y - 93     1.150E+01 8.053E-01 1.740E+00 5.854E+00 1.120E+00
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40-ZR- 91	1.036E+01	8.000E-01	7.822E-01	5.057E+00	1.200E+00
40-ZR- 92	1.088E+01	8.192E-01	5.122E-01	6.429E+00	1.920E+00
40-ZR- 93	1.298E+01	7.000E-01	1.273E+00	5.183E+00	1.200E+00
40-ZR- 94	1.275E+01	7.530E-01	4.411E-01	7.019E+00	2.320E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 6.100 FOR ZR- 93 AND 5.524 FOR ZR- 94.

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MAT number = 4037
 40-ZR- 94 JNDC       EVAL-AUG89 JNDC FP NUCLEAR DATA W.G.
                      DIST-SEP90 REV-SEP93
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
89-08 MODIFICATION FOR JENDL-3 WAS MADE/2/.
90-10 MF=5: SPECTRA AT THRESHOLD ENERGIES WERE MODIFIED.
93-09 JENDL-3.2.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (3,2), (3,4), (3,16), (3,17), (3,51-91)
      (4,16-91)
      (5,16-91)
             THESE DATA WERE TAKEN FROM JENDL FUSION FILE.
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      JENDL FUSION FILE /3/  (AS OF SEP. 1993)
            EVALUATED AND COMILED BY S. CHIBA (NDC/JAERI)

      DATA WERE TAKEN FROM JENDL-3.1 EXCEPT FOR THE FOLLOWING:
      -  THE DISCRETE AND CONTINUUM INELASTIC SCATTERING CROSS
         SECTIONS WERE CALCULATED WITH CASTHY2Y AND DWUCKY IN
         SINCROS-II SYSTEM/4/ INCLUDING CONTRIBUTIONS FROM
         DIRECT REACTIONS.
      -  ANGULAR DISTRIBUTIONS OF DISCRETE INELASTICS WERE ALSO
         CALCULATED WITH CASTHY2Y AND DWUCKY.
      -  THE (N,2N) AND (N,3N) REACTION CROSS SECTIONS (MT=16, 17)
         WERE REPLACED WITH THOSE CALCULATED BY EGNASH2 IN THE
         SINCROS-II.
      -  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE REPLACED
         BY THOSE CALCULATED BY EGNASH2 EXCEPT FOR MT=32 WHICH WAS
         NOT TAKEN INTO ACCOUNT IN EGNASH2.  THE DDX'S OF THE
         CONTINUUM NEUTRONS WERE CALCULATED BY KUMABE'S SYSTEMA-
         TICS /5/ USING F15TOB /3/.  THE PRECOMPOUND/COMPOUND
         RATIO WAS CALCULATED BY THE SINCROS- II CODE SYSTEM.
      -  OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED IN
         THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./4/.
         LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/6/.
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MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 53.5 KEV
    RESONANCE PARAMETERS WERE TAKEN FROM JENDL-2.
       PARAMETERS WERE DETERMINED ON THE BASIS OF MEASURED DATA BY
    BOLDEMAN ET AL./7/  A NEGATIVE RESONANCE WAS ADDED TO
    REPRODUCE THE CAPTURE CROSS SECTION OF 0.0499 BARN AND THE
    ELASTIC SCATTERING CROSS SECTION OF 6.1 BARN AT 0.0253 EV/8/.
    AVERAGE RADIATION WIDTHS OF 0.090 EV AND 0.175 EV WERE ADOPTED
    TO S-WAVE AND P-WAVE RESONANCES, RESPECTIVELY.

  UNRESOLVED RESONANCE REGION : 53.5 KEV - 100 KEV
    UNRESOLVED RESONANCE PARAMETERS WERE ADOPTED FROM JENDL-2.
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/9/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.370E-4, S1 = 5.500E-4, S2 = 0.360E-4, SG = 0.534E-4,
    GG = 0.190 EV, R  = 6.704 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                      2200 M/S               RES. INTEG.
      TOTAL           6.202                     -
      ELASTIC         6.152                     -
      CAPTURE         0.04981                    0.321

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/10/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
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EVAPORATION MODEL. THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE DETERMINED BY IIJIMA AND KAWAI/11/ TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS SECTION. THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:

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   PROTON   = PEREY/12/
   ALPHA    = HUIZENGA AND IGO/13/
   DEUTERON = LOHR AND HAEBERLI/14/
   HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/15/
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PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT AND CAMERON/16/ WERE EVALUATED BY IIJIMA ET AL./17/ MORE EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE PRESENT WORK. TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED IN THE PRESENT CALCULATION. ENERGY DEPENDENCE OF SPIN CUT-OFF PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR /18/.

FOR JENDL-3.2, DATA OF INELASTIC, (N,2N) AND (N,3N) REACTION CROSS SECTIONS WERE ADOPTED FROM JENDL FUSION FILE. THE CALCULATION WAS MADE WITH SINCROS-II SYSTEM/4/ BY ADOPTING WALTER-GUSS OMP MODIFIED BY YAMAMURO/4/ FOR NEUTRONS, LEMOS OMP MODIFIED BY ARTHUR AND YOUNG/19/ FOR ALPHA, THE SAME OMP'S AS THE PEGASUS CALCULATION FOR OTHER CHARGED PARTICLES AND STANDARD LEVEL DENSITY PARAMETERS OF SINCROS-II SYSTEM.

MT = 1 TOTAL
  SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

MT = 2 ELASTIC SCATTERING
  CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

MT = 4, 51 - 91 INELASTIC SCATTERING
  TAKEN FROM JENDL FUSION FILE. THE LEVEL SCHEME WAS TAKEN FROM REF./6/ CONTRIBUTIONS OF THE DIRECT PROCESS WAS CALCULATED FOR THE LEVELS MARKED WITH '*'.

NO.	ENERGY(MEV)	SPIN-PARITY	(DIRECT PROCESS)
GR.	0.0	0 +	
1	0.9187	2 +	*
2	1.3002	0 +	
3	1.4696	4 +	
4	1.6714	2 +	
5	2.0576	3 -	*
6	2.1513	2 +	
7	2.3302	4 +	
8	2.3661	2 +	
9	2.5077	3 +	*
10	2.6045	5 -	
11	2.6985	1 +	
12	2.8260	2 +	
13	2.8463	1 +	
14	2.8606	4 +	*

LEVELS ABOVE 2.861 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
  TAKEN FROM JENDL FUSION FILE.

MT = 102 CAPTURE
  SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/20/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

  THE GAMMA-RAY STRENGTH FUNCTION (4.89E-05) WAS ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION OF 19 MILLI-BARNS AT 100 KEV MEASURED BY MUSGROVE ET AL./21/

MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT = 32 (N,N'D) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
  THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

  THE KALBACH'S CONSTANT K (= 161.8) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/22/ AND LEVEL DENSITY PARAMETERS.

  FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE

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    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,P)          10.00  MB (RECOMMENDED BY FORREST/23/)
      (N,ALPHA)       4.80  MB (MEASURED BY IKEDA+/24/)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT = 2
    CALCULATED WITH CASTHY/9/.
  MT = 51-64
    TAKEN FROM JENDL FUSION FILE DATA WHICH WAS CALCULATED WITH
    CASTHY AND DWUCK/25/ (DWUCKY) IN THE SINCROS-II SYSTEM.
  MT = 16,17,22,28,32,91
    TRANSFORMED FROM MF=6 DATA (DDX) OF JENDL FUSION FILE.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT = 16,17,22,28,91
    TRANSFORMED FROM MF=6 DATA (DDX) OF JENDL FUSION FILE.
  MT = 32
    CALCULATED WITH PEGASUS.


=================================================================
<<FOLLOWING ARE PARAMETERS USED IN THE CASTHY AND PEGASUS CALC.>>
=================================================================

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
         ----------------------   ------------  ---------------
        V  = 46.0-0.25E           R0 = 5.893    A0 = 0.62
        WS = 7.0                  RS = 6.393    AS = 0.35
        VSO= 7.0                  RSO= 5.893    ASO= 0.62
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2  LEVEL DENSITY PARAMETERS

 NUCLIDE  SYST A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
 -------------------------------------------------------------
 38-SR- 90      9.940E+00 8.530E-01 3.795E-01 6.252E+00 1.960E+00
 38-SR- 91      1.090E+01 8.100E-01 1.103E+00 5.625E+00 1.240E+00
 38-SR- 92   *  1.288E+01 7.065E-01 2.515E-01 6.391E+00 2.360E+00
 38-SR- 93   *  1.386E+01 6.989E-01 1.878E+00 5.664E+00 1.240E+00

 39-Y - 91      1.050E+01 7.140E-01 8.362E-01 3.521E+00 7.200E-01
 39-Y - 92      1.012E+01 7.629E-01 2.480E+00 3.191E+00 0.0
 39-Y - 93      1.150E+01 8.053E-01 1.740E+00 5.854E+00 1.120E+00
 39-Y - 94      9.149E+00 7.385E-01 1.378E+00 2.222E+00 0.0

 40-ZR- 92      1.088E+01 8.192E-01 5.122E-01 6.429E+00 1.920E+00
 40-ZR- 93      1.298E+01 7.000E-01 1.273E+00 5.183E+00 1.200E+00
 40-ZR- 94      1.275E+01 7.530E-01 4.411E-01 7.019E+00 2.320E+00
 40-ZR- 95      1.331E+01 6.070E-01 5.453E-01 3.985E+00 1.200E+00
 -------------------------------------------------------------
  SYST:  * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

 SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
 IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
 ASSUMED TO BE 5.524 FOR ZR- 94 AND 5.652 FOR ZR- 95.

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MAT number = 4040

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 40-ZR- 95 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  NO RESOLVED RESONANCE PARAMETERS

  UNRESOLVED RESONANCE REGION : 125 EV - 100 KEV
    UNRESOLVED RESONANCE PARAMETERS WERE ADOPTED FROM JENDL-2.
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/3/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.370E-4, S1 = 5.420E-4, S2 = 0.360E-4, SG = 8.03E-4,
    GG = 0.200 EV, R  = 6.737 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           6.904                   -
      ELASTIC         5.704                   -
      CAPTURE         1.200                    7.79

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 125 EV, THE CAPTURE AND ELASTIC SCATTERING CROSS SECTIONS
  WERE ASSUMED TO BE IN 1/V FORM AND CONSTANT, RESPECTIVELY.
  THE CAPTURE CROSS SECTION AT 0.0253 EV WAS DETERMINED BY THE
  SYSTEMATICS FROM THE NEIGHBORING ZR ISOTOPES.  THE SCATTERING
  CROSS SECTION WAS CALCULATED FROM R = 6.737 FM.  UNRESOLVED
  RESONANCE PARAMETERS WERE GIVEN IN THE ENERGY RANGE FROM 125 EV
  TO 100 KEV.

  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/4/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED BY IIJIMA AND KAWAI/5/ TO REPRODUCE A SYSTEMATIC
  TREND OF THE TOTAL CROSS SECTION.  THE OMP'S FOR CHARGED
  PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/6/
     ALPHA    = HUIZENGA AND IGO/7/
     DEUTERON = LOHR AND HAEBERLI/8/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/9/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/10/ WERE EVALUATED BY IIJIMA ET AL./11/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /12/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./13/

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0            5/2 +
            1        0.9530         1/2 +
            2        1.1730         3/2 +
            3        1.3190         3/2 +
            4        1.6180         7/2 +
            5        1.6180         3/2 +
            6        1.7180         3/2 +
            7        1.7890         5/2 +
            8        1.8960         3/2 +
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              9          1.9400           5/2 +
             10          2.0180          11/2 -
             11          2.2520           3/2 +
             12          2.2800           1/2 +
             13          2.2910           3/2 +
             14          2.3760           3/2 +
             15          2.4500           7/2 +
             16          2.6250           3/2 +
             17          2.6250          11/2 -
             18          2.7240           7/2 +
             19          2.8340           3/2 -
             20          2.8340          11/2 -
             21          2.9960           3/2 +
             22          3.0620           3/2 +
             23          3.1170          11/2 -
         LEVELS ABOVE 3.205 MEV WERE ASSUMED TO BE OVERLAPPING.

    MT = 102  CAPTURE
      SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
      CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
      SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
      AND REFFO/14/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

      THE GAMMA-RAY STRENGTH FUNCTION (8.00E-04) WAS DETERMINED FROM
      THE SYSTEMATICS OF RADIATION WIDTH (0.2 EV) AND AVERAGE S-WAVE
      RESONANCE LEVEL SPACING (250 EV).

    MT = 16  (N,2N) CROSS SECTION
    MT = 17  (N,3N) CROSS SECTION
    MT = 22  (N,N'A) CROSS SECTION
    MT = 28  (N,N'P) CROSS SECTION
    MT = 32  (N,N'D) CROSS SECTION
    MT =103  (N,P) CROSS SECTION
    MT =104  (N,D) CROSS SECTION
    MT =105  (N,T) CROSS SECTION
    MT =107  (N,ALPHA) CROSS SECTION
      THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
      PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

      THE KALBACH'S CONSTANT K (= 171.2) WAS ESTIMATED BY THE
      FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/15/ AND LEVEL
      DENSITY PARAMETERS.

      FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
      NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
        (N,P)           5.68  MB (SYSTEMATICS OF FORREST/16/)
        (N,ALPHA)       1.61  MB (SYSTEMATICS OF FORREST)

    MT = 251  MU-BAR
      CALCULATED WITH CASTHY.

  MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
    LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
    GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
    TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
    CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
    BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

  MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
    ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
    PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
    OTHER NEUTRON EMITTING REACTIONS.

  TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                   DEPTH (MEV)        RADIUS(FM)    DIFFUSENESS(FM)
             ----------------------  ------------  ---------------
           V  = 46.0-0.25E           R0 = 5.893    A0 = 0.62
           WS = 7.0                  RS = 6.393    AS = 0.35
           VSO= 7.0                  RSO= 5.893    ASO= 0.62
    THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

  TABLE 2  LEVEL DENSITY PARAMETERS

   NUCLIDE  SYST A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
   ---------------------------------------------------------------
   38-SR- 91      1.090E+01 8.100E-01 1.103E+00 5.625E+00 1.240E+00
   38-SR- 92   *  1.288E+01 7.065E-01 2.515E-01 6.391E+00 2.360E+00
   38-SR- 93   *  1.386E+01 6.989E-01 1.878E+00 5.664E+00 1.240E+00
   38-SR- 94   *  1.485E+01 6.915E-01 4.495E-01 7.333E+00 2.530E+00

   39-Y - 92      1.012E+01 7.629E-01 2.480E+00 3.191E+00 0.0
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39-Y - 93	1.150E+01	8.053E-01	1.740E+00	5.854E+00	1.120E+00
39-Y - 94	9.149E+00	7.385E-01	1.378E+00	2.222E+00	0.0
39-Y - 95	1.070E+01	8.306E-01	1.082E+00	5.839E+00	1.290E+00
40-ZR- 93	1.298E+01	7.000E-01	1.273E+00	5.183E+00	1.200E+00
40-ZR- 94	1.275E+01	7.530E-01	4.411E-01	7.019E+00	2.320E+00
40-ZR- 95	1.331E+01	6.070E-01	5.453E-01	3.985E+00	1.200E+00
40-ZR- 96	1.320E+01	7.000E-01	2.235E-01	6.589E+00	2.490E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 5.652 FOR ZR- 95 AND 3.791 FOR ZR- 96.

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MAT number = 4043

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 40-ZR- 96 JNDC       EVAL-AUG89 JNDC FP NUCLEAR DATA W.G.
                      DIST-SEP90 REV2-SEP93
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
89-08 MODIFICATION FOR JENDL-3 WAS MADE/2/.
90-10 MF=5: SPECTRA AT THRESHOLD ENERGIES WERE MODIFIED.
93-09 JENDL-3.2.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (3,2), (3,4), (3,16), (3,17), (3,51-91)
      (4,16-91)
      (5,16-91)
             THESE DATA WERE TAKEN FROM JENDL FUSION FILE.
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      JENDL FUSION FILE /3/  (AS OF SEP. 1993)
            EVALUATED AND COMILED BY S. CHIBA (NDC/JAERI)

      DATA WERE TAKEN FROM JENDL-3.1 EXCEPT FOR THE FOLLOWING:
      -  THE DISCRETE AND CONTINUUM INELASTIC SCATTERING CROSS
         SECTIONS WERE CALCULATED WITH CASTHY2Y AND DWUCKY IN
         SINCROS-II SYSTEM/4/ INCLUDING CONTRIBUTIONS FROM
         DIRECT REACTIONS.
      -  ANGULAR DISTRIBUTIONS OF DISCRETE INELASTICS WERE ALSO
         CALCULATED WITH CASTHY2Y AND DWUCKY.
      -  THE (N,2N) AND (N,3N) REACTION CROSS SECTIONS (MT=16, 17)
         WERE REPLACED WITH THOSE CALCULATED BY EGNASH2 IN THE
         SINCROS-II.
      -  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE REPLACED
         BY THOSE CALCULATED BY EGNASH2.  THE DDX'S OF THE
         CONTINUUM NEUTRONS WERE CALCULATED BY KUMABE'S SYSTEMA-
         TICS /5/ USING F15TOB /3/.  THE PRECOMPOUND/COMPOUND
         RATIO WAS CALCULATED BY THE SINCROS- II CODE SYSTEM.
      -  OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED IN
         THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./4/.
         LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/6/.
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MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 100 KEV
    RESONANCE PARAMETERS WERE TAKEN FROM JENDL-2.
       RESONANCE ENERGIES AND NEUTRON WIDTHS WERE BASED ON THE
    MEASURED VALUES BY COCEVA ET AL./7/ BELOW 41.5 KEV AND THOSE
    BY MUSGROVE ET AL./8/ ABOVE 41.5 KEV.  THE NEUTRON WIDTHS OF
    MUSGROVE ET AL. WERE MULTIPLIED BY A FACTOR OF 1.79 SO AS TO
    ADJUST TO THE DATA OF COCEVA ET AL.  THE RADIATION WIDTHS WERE
    ADOPTED FROM BRUSEGAN ET AL./9/  THE PARAMETERS OF THE 301-EV
    LEVEL WERE TAKEN FROM SALAH ET AL./10/  PARAMETER OF A NEGA-
    TIVE RESONANCE WAS BASED ON THE RECOMMENDED PARAMETERS GIVEN
    IN REF./11/, AND THE RADIATION WIDTH WAS MODIFIED SO AS TO
    REPRODUCE THE CAPTURE CROSS SECTION OF 0.0229+-0.0010 BARNS AT
    0.0253 EV/11/.  AVERAGE RADIATION WIDTHS OF 0.068+-0.010 EV
    AND 0.170+-0.130 EV WERE ADOPTED TO S-WAVE AND P-WAVE
    RESONANCES, RESPECTIVELY.

  NO UNRESOLVED RESONANCE REGION

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL          6.154                    -
      ELASTIC        6.131                    -
      CAPTURE        0.02280                   5.87

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESOLVED RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY/12/, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/13/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED BY IIJIMA AND KAWAI/14/ TO REPRODUCE A SYSTEMATIC
  TREND OF THE TOTAL CROSS SECTION.  THE OMP'S FOR CHARGED
  PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/15/
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    ALPHA     = HUIZENGA AND IGO/16/
    DEUTERON = LOHR AND HAEBERLI/17/
    HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/18/
 PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
 AND CAMERON/19/ WERE EVALUATED BY IIJIMA ET AL./20/  MORE
 EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
 PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
 IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
 PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
 /21/.

    FOR JENDL-3.2, DATA OF INELASTIC, (N,2N) AND (N,3N) REACTION
 CROSS SECTIONS WERE ADOPTED FROM JENDL FUSION FILE.  THE
 CALCULATION WAS MADE WITH SINCROS-II SYSTEM/4/ BY ADOPTING
 WALTER-GUSS OMP MODIFIED BY YAMAMURO/4/ FOR NEUTRONS, LEMOS OMP
 MODIFIED BY ARTHUR AND YOUNG/22/ FOR ALPHA, THE SAME OMP'S AS
 THE PEGASUS CALCULATION FOR OTHER CHARGED PARTICLES AND STANDARD
 LEVEL DENSITY PARAMETERS OF SINCROS-II SYSTEM.

 MT = 1  TOTAL
   SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

 MT = 2  ELASTIC SCATTERING
   CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

 MT = 4, 51 - 91  INELASTIC SCATTERING
   TAKEN FROM JENDL FUSION FILE.  THE LEVEL SCHEME WAS TAKEN FROM
   REF./6/  CONTRIBUTIONS OF THE DIRECT PROCESS WAS CALCULATED
   FOR THE LEVELS MARKED WITH '*'.

          NO.      ENERGY(MEV)    SPIN-PARITY (DIRECT PROCESS)
          GR.        0.0            0  +
           1         1.5940         0  +
           2         1.7505         2  +          *
           3         1.8971         3  -          *
           4         2.2259         1  -
           5         2.3300         2  +
           6         2.4400         1  -
           7         2.8574         3  -
     LEVELS ABOVE 2.857 MEV WERE ASSUMED TO BE OVERLAPPING.

 MT = 16  (N,2N) CROSS SECTION
 MT = 17  (N,3N) CROSS SECTION
   DATA FOR JENDL FUSION FILE WERE ADOPTED.

 MT = 102  CAPTURE
   SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
   CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
   SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
   AND REFFO/23/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

   THE GAMMA-RAY STRENGTH FUNCTION (1.40E-5) WAS ADJUSTED TO
   REPRODUCE THE CAPTURE CROSS SECTION OF 12 MILLI-BARNS AT 30
   KEV MEASURED BY WYRICK/24/

 MT = 22  (N,N'A) CROSS SECTION
 MT = 28  (N,N'P) CROSS SECTION
 MT =103  (N,P) CROSS SECTION
 MT =104  (N,D) CROSS SECTION
 MT =105  (N,T) CROSS SECTION
 MT =107  (N,ALPHA) CROSS SECTION
   THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
   PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

   THE KALBACH'S CONSTANT K (= 203.6) WAS ESTIMATED BY THE
   FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/25/ AND LEVEL
   DENSITY PARAMETERS.

   FINALLY, THE (N,2N), (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
   NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
     (N,2N)       1500.00  MB (MEASURED BY IKEDA+/26/)
     (N,P)           3.79  MB (SYSTEMATICS OF FORREST/27/)
     (N,ALPHA)       3.00  MB (RECOMMENDED BY FORREST/27/)

 MT = 251  MU-BAR
   CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT = 2
   CALCULATED WITH CASTHY/12/.
 MT = 51-57
   TAKEN FROM JENDL FUSION FILE DATA WHICH WAS CALCULATED WITH
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    CASTHY2Y AND DWUCK/28/ (DWUCKY) IN THE SINCROS-II SYSTEM.
  MT = 16,17,22,28,91
    TRANSFORMED FROM MF=6 DATA (DDX) OF JENDL FUSION FILE.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT = 16,17,22,28,91
    TRANSFORMED FROM MF=6 DATA (DDX) OF JENDL FUSION FILE.


=================================================================
<<FOLLOWING ARE PARAMETERS USED IN THE CASTHY AND PEGASUS CALC.>>
=================================================================

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

             DEPTH (MEV)       RADIUS(FM)   DIFFUSENESS(FM)
         ----------------------  ------------ ---------------
        V  = 46.0-0.25E          R0 = 5.893    A0 = 0.62
        WS = 7.0                 RS = 6.393    AS = 0.35
        VSO= 7.0                 RSO= 5.893    ASO= 0.62
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2  LEVEL DENSITY PARAMETERS

 NUCLIDE  SYST A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
 ---------------------------------------------------------------
 38-SR- 92  *  1.288E+01 7.065E-01 2.515E-01 6.391E+00 2.360E+00
 38-SR- 93  *  1.386E+01 6.989E-01 1.878E+00 5.664E+00 1.240E+00
 38-SR- 94  *  1.485E+01 6.915E-01 4.495E-01 7.333E+00 2.530E+00
 38-SR- 95  *  1.586E+01 6.842E-01 4.531E+00 6.411E+00 1.240E+00

 39-Y - 93     1.150E+01 8.053E-01 1.740E+00 5.854E+00 1.120E+00
 39-Y - 94     9.149E+00 7.385E-01 1.378E+00 2.222E+00 0.0
 39-Y - 95     1.070E+01 8.306E-01 1.082E+00 5.839E+00 1.290E+00
 39-Y - 96  *  1.603E+01 6.771E-01 2.794E+01 5.117E+00 0.0

 40-ZR- 94     1.275E+01 7.530E-01 4.411E-01 7.019E+00 2.320E+00
 40-ZR- 95     1.331E+01 6.070E-01 5.453E-01 3.985E+00 1.200E+00
 40-ZR- 96     1.320E+01 7.000E-01 2.235E-01 6.589E+00 2.490E+00
 40-ZR- 97     1.259E+01 5.590E-01 2.497E-01 3.084E+00 1.200E+00
 ---------------------------------------------------------------
  SYST:  * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

 SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
 IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
 ASSUMED TO BE 3.791 FOR ZR- 96 AND 5.0 FOR ZR- 97.
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MAT number = 4125
 41-NB- 93 NAIG       EVAL-NOV88 M.KAWAI, N.YAMAMURO
                      DIST-SEP89 REV2-FEB94
HISTORY
82-10 EVALUATION OF RESONANCE PARAMETERS FOR JENDL-2 WAS MADE
      BY KAWAI.
88-10 EVALUATION WAS PERFORMED FOR JENDL-3.
88-10 COMPILED BY K.SHIBATA (JAERI).
94-02 JENDL-3.2
        RESONANCE PARAMETERS MODIFIED BY M.KAWAI(TOSHIBA).
        GAMMA-RAY PRODUCTION DATA BY S.IGARASI(NEDAC).
        OTHER DATA WERE ADOPTED FROM JENDL FUSION FILE.
      COMPILED BY T.NAKAGAWA

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)      RESOLVED RESONANCE PARAMETERS MODIFIED
      (3,1), (3,2), (3,4), (3,51-91) FROM JENDL FUSION FILE
      (4,16-91)    TAKEN FROM JENDL FUSION FILE
      (5,16-91)    TAKEN FROM JENDL FUSION FILE
      (12,102)     BELOW 100 KEV
      (15,102)     BELOW 100 KEV
     ***********************************************************
     -------------------------------------------------------------
      JENDL FUSION FILE /1/  (AS OF FEB. 1994)
            EVALUATED BY B.YU(CIAE) AND S.CHIBA (NDC/JAERI)
            COMPILED  BY S.CHIBA.

       - CROSS SECTIONS WERE MAINLY TAKEN FROM JENDL-3.1 EXCEPT
         FOR THE (N,2N) AND CONTINUUM INELASTIC SCATTERING CROSS
         SECTIONS WHICH WERE TAKEN FROM THE SINCROS-II/2/
         CALCULATION.  INTERPOLATION SCHEME OF THE DISCRETE
         INELASTIC SCATTERING CROSS SECTIONS WAS CHANGED FROM 3
         TO 2.  THE TOTAL CROSS SECTION AT 10 AND 15 KEV, WHICH
         IS THE BACKGROUND CROSS SECTION, WERE SET TO 0.0.
       - ENERGY DISTRIBUTIONS WERE REPLACED WITH THE SINCROS-II
         CALCULATION.
       - MF=6 WAS MADE BY THE F15TOB PROGRAM/1/.  THE PRECOM-
         UND TO COMPOUND RATIO WAS TAKEN FROM OUTPUT OF THE
         SINCROS-II CALCULATION.  KALBACH'S SYSTEMATICS/3/ WAS
         ADOPTED FOR DDX.
       - OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED IN
         THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./2/.
         LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/4/.
     -------------------------------------------------------------


MF=1          GENERAL INFORMATION
  MT=451    DESCRIPTIVE DATA AND DICTIONARY

MF=2          RESONANCE PARAMETERS
  MT=151
  RESOLVED RESONANCES: 1.0E-5 EV - 7 KEV
     PARAMETERS IN JENDL-3.1 WERE TAKEN FROM JENDL-2 BY MODIFING J
     VALUES.  THE JENDL-2 PARAMETERS WERE EVALUATED ON THE BASIS
     OF FOLLOWING MEASUREMENTS:
       TRANSMISSION  BY GARG ET AL./5/, POITTEVIN ET AL./6/
                     AND ILIESCU ET AL./7/
       SCATTERING    BY ILIESCU ET AL./7/
       CAPTURE       BY MACKLIN /8/, LOPEZ ET AL./9/ AND
                     ILIESCU ET AL. /7/
     J VALUES DETERMINED BY HASTE ET AL. /10/  WERE ADOPTED.
     AVERAGE RADIATIVE WIDTH WAS ASSUMED TO BE 0.172 EV (0.212 EV
     FOR DOUBLET), AND SCATTERING RADIUS TO BE 7.10 FM.  THE J
     VALUES OF RESONANCES WITHOUT KNOWN J VALUES WERE RANDOMLY
     ASSIGNED.

     FOR JENDL-3.2, RE-ASSIGNMENT OF J AND MODIFICATION OF NEUTRON
     AND RADIATIVE WIDTHS WERE MADE TO REPRODUCE THE MEASURED
     CAPTURE AREA DATA/8/.

  UNRESOLVED RESONANCES: 7 KEV - 100 KEV
     DETERMINED WITH THE ASREP CODE/11/ SO AS TO REPRODUCE
     THE EVALUATED SIG-C AND SIG-T UP TO 100 KEV.

     TYPICAL PARAMETERS AT 70 KEV:
       S0= 0.4E-4, S1=6.68E-4, D-OBS=96.0 EV, R=6.477 FM,
       RADIATIVE WIDTH= 0.172 EV

     CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS

                 2200-M/S         RES. INTEG.
      ELASTIC    6.319 B              -
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CAPTURE	1.149 B	9.445 B
TOTAL	7.468 B	-

MF=3 NEUTRON CROSS SECTIONS

MT=1 TOTAL
BELOW 100 KEV : BACKGROUND CROSS SECTIONS GIVEN.
100 KEV TO 20 MEV: SPLINE-FUNCTION FITTING TO THE EXPERIMENTAL DATA/12/.

MT=2 ELASTIC SCATTERING
(TOTAL) - (REACTION CROSS SECTION)

MT=4,51-62,91 INELASTIC SCATTERING
THE INELASTIC SCATTERING CROSS SECTIONS TO DISCRETE LEVELS WERE CALCULATED WITH THE STATISTICAL-MODEL CODE CASTHY /13/, CONSIDERING LEVEL FLUCTUATION, USING MODIFIED WALTER-GUSS POTENTIAL PARAMETERS FOR NEUTRONS. THE COMPONENTS OF THE DIRECT PROCESS WERE ADDED TO THE LEVELS OF MT=53, 54, 56, 57, 58, 60 BY USING THE DWUCK CODE /14/. THE CROSS SECTION TO CONTINUUM WAS CALCULATED WITH THE THE GNASH CODE /15/ CONSIDERING PRE-EQUILIBRIUM. THE MODIFICATION MADE FOR JENDL FUSION FILE WAS ALSO ADOPTED TO JENDL-3.2.

THE LEVEL SCHEME IS GIVEN AS FOLLOWS:

NO.	ENERGY(MEV)	SPIN-PARITY
G.S	0.0	9/2 +
1.	0.0304	1/2 -
2.	0.6860	3/2 -
3.	0.7440	7/2 +
4.	0.8087	5/2 +
5.	0.8101	3/2 -
6.	0.9499	13/2 +
7.	0.9791	11/2 +
8.	1.0826	9/2 +
9.	1.2900	3/2 -
10.	1.2974	9/2 +
11.	1.3156	5/2 +
12.	1.3351	17/2 +

LEVELS ABOVE 1.34 MEV WERE ASSUMED TO BE OVERLAPPING.

OPTICAL-MODEL PARAMETERS ARE AS FOLLOWS:
V=52.56-0.30*EN, WS=3.233+0.271*EN, VSO=6.004-0.015*EN
VSYM=-16.5 , WI=-0.963+0.153*EN, WSO=0.291-0.018*EN
R0=1.229 , RS=1.282 , RI=1.42, RSO=1.103
A0=0.688 , B=0.512 , AI=0.509, ASO=0.56

THE LEVEL DENSITY PARAMETERS FOR GNASH AND CASTHY CALCULATIONS ARE AS FOLLOWS:

	A (1/MEV)	EX (MEV)	T (MEV)	DS (EV)	GAMMA-G (EV)
NB-94	14.4	4.059	0.719	30.0	0.052
NB-93	13.0	5.884	0.834	-	0.170
NB-92	11.5	3.254	0.790	-	0.170
NB-91	11.0	5.461	0.895	-	0.170
ZR-93	13.7	5.923	0.781	-	0.140
ZR-92	11.9	6.284	0.858	-	0.140
Y-90	11.1	1.441	0.721	1210.	0.130
Y-89	10.7	2.946	0.762	-	0.130

MT=16 (N,2N)
BASED ON THE EXPERIMENTAL DATA/16,17/.

MT=17,22,28,103,104,107 (N,3N),(N,N'A),(N,N'P),(N,P) (N,D) AND (N,A) CROSS SECTIONS
CALCULATED WITH GNASH/15/.
OPTICAL POTENTIAL PARAMETERS FOR PROTON, ALPHA-PARTICLE AND DEUTERON WERE TAKEN FROM THE WORKS OF PEREY/18/, LEMOS/19/ AND LOHR AND HAEVERLI/20/, RESPECTIVELY.

MT=102 RADIATIVE CAPTURE CROSS SECTION
1.0E-5 EV TO 100 KEV: RESONANCE PARAMETERS GIVEN.
100 KEV TO 20 MEV: CALCULATED WITH THE CASTHY CODE/13/.
T-GAMMA=0.0109; DETERMINED SO AS TO REPRODUCE SIG-C=107MB AT 100 KEV, MEASURED BY REFFO ET AL./21/

MT=251 MU-BAR
CALCULATED FROM FILE-4.

MF=4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=2,51-62

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        CALCULATED WITH CASTHY FOR EQUILIBRIUM PROCESS.  THE
        COMPONENTS OF THE DIRECT PROCESS WERE ADDED TO THE LEVELS
        OF MT=53,54,56,57,58,60 BY USING THE DWUCK CODE /14/.
  MT=16, 17, 22, 28, 91
        TAKEN FROM JENDL FUSION FILE.

MF=5          ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16, 17, 22, 28, 91
        TAKEN FROM JENDL FUSION FILE.

MF=12         PHOTON PRODUCTION MULTIPLICITIES
  MT=16,17,22,28,52-62,91,103,104,107
        CALCULATED WITH GNASH.
  MT=102
        FROM ENERGY BALANCE.

MF=14         PHOTON ANGULAR DISTRIBUTIONS
  MT=16,17,22,28,52-62,91,102,103,104,107
        ASSUMED TO BE ISOTROPIC.

MF=15         PHOTON ENERGY DISTRIBUTIONS
  MT=16,17,22,28,91,103,104,107
        CALCULATED WITH GNASH.
  MT=102
        CALCULATED WITH CASTHY, REFERRING TO THE COMPILATION OF
        GAMMA-RAY SPECTRA FOR THERMAL NEUTRON BY LONE ET AL./22/
        PRIMARY TRANSITIONS WERE TAKEN INTO ACCOUNT AT 1.0E-5,
        2.53E-2, 1.0E+1, 1.0E+3, 3.0E+4 AND 1.0E+5 EV.
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MAT number = 4128

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 41-NB- 94 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 0.028 KEV
    PARAMETERS WERE TAKEN FROM THE COMPILATION OF MUGHABGHAB ET
    AL./2/  TOTAL SPIN J OF SOME RESONANCES WAS TENTATIVELY
    ESTIMATED WITH A RANDOM NUMBER METHOD.  A NEGATIVE RESONANCE
    WAS ADDED SO AS TO REPRODUCE THE THERMAL CAPTURE CROSS SECTION
    (15.5 BARNS) GIVEN BY MUGHABGHAB ET AL./2/  SCATTERING RADIUS
    WAS ASSUMED TO BE 7.0 FM ACCORDING TO THE SYSTEMATICS OF
    MEASURED VALUES.

  UNRESOLVED RESONANCE REGION : 0.028 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/3/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.  THE RADIATION WIDTH WAS TAKEN FROM THE COMPILATION
    OF MUGHABGHAB ET AL.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.400E-4, S1 = 5.500E-4, S2 = 0.400E-4, SG = 25.2E-4,
    GG = 0.188 EV, R  = 6.696 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                      2200 M/S               RES. INTEG.
      TOTAL           22.22                     -
      ELASTIC          6.453                    -
      CAPTURE         15.77                   126

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/4/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED BY IIJIMA AND KAWAI/5/ TO REPRODUCE A SYSTEMATIC
  TREND OF THE TOTAL CROSS SECTION.  THE OMP'S FOR CHARGED
  PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/6/
     ALPHA    = HUIZENGA AND IGO/7/
     DEUTERON = LOHR AND HAEBERLI/8/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/9/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/10/ WERE EVALUATED BY IIJIMA ET AL./11/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /12/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/13/ AND NUCLEAR DATA
    SHEETS/14/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             6  +
            1        0.0410          3  +
            2        0.0587          4  +
            3        0.0787          7  +
            4        0.1134          5  +
            5        0.1403          2  -
            6        0.3016          2  -
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               7         0.3119          4   +
               8         0.3342          3   +
               9         0.3963          3   -
              10         0.4502          3   -
              11         0.6317          4   +
              12         0.6409          5   +
              13         0.6657          3   +
              14         0.7849          3   +
              15         0.7929          3   -
              16         0.8178          3   -
              17         0.8957          3   +
              18         0.9240          2   +
              19         0.9352          0   +
              20         0.9586          5   +
              21         0.9790          2   -
              22         1.0077          4   +
              23         1.0612          4   +
              24         1.0857          2   +
              25         1.1633          3   +
              26         1.1707          4   +
              27         1.2020          0   +
              28         1.2327          2   +
              29         1.2569          0   +
         LEVELS ABOVE 1.264 MEV WERE ASSUMED TO BE OVERLAPPING.

    MT = 102  CAPTURE
      SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
      CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
      SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
      AND REFFO/15/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

      THE GAMMA-RAY STRENGTH FUNCTION (2.53E-03) WAS DETERMINED FROM
      THE SYSTEMATICS OF RADIATION WIDTH (0.188 EV) AND THE AVERAGE
      S-WAVE RESONANCE LEVEL SPACING (74.4 EV) CALCULATED FROM THE
      LEVEL DENSITY PARAMETERS.

    MT = 16  (N,2N) CROSS SECTION
    MT = 17  (N,3N) CROSS SECTION
    MT = 22  (N,N'A) CROSS SECTION
    MT = 28  (N,N'P) CROSS SECTION
    MT = 32  (N,N'D) CROSS SECTION
    MT = 33  (N,N'T) CROSS SECTION
    MT =103  (N,P) CROSS SECTION
    MT =104  (N,D) CROSS SECTION
    MT =105  (N,T) CROSS SECTION
    MT =106  (N,HE3) CROSS SECTION
    MT =107  (N,ALPHA) CROSS SECTION
      THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
      PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

      THE KALBACH'S CONSTANT K (= 183.2) WAS ESTIMATED BY THE
      FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/16/ AND LEVEL
      DENSITY PARAMETERS.

      FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
      NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
        (N,P)           22.20  MB (SYSTEMATICS OF FORREST/17/)
        (N,ALPHA)        6.42  MB (SYSTEMATICS OF FORREST)

    MT = 251  MU-BAR
      CALCULATED WITH CASTHY.

  MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
    LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
    GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
    TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
    CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
    BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

  MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
    ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
    PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
    OTHER NEUTRON EMITTING REACTIONS.

  TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                   DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
            ----------------------   ------------  ---------------
           V  = 46.0-0.25E           R0 = 5.893    A0 = 0.62
           WS = 7.0                  RS = 6.393    AS = 0.35
           VSO= 7.0                  RSO= 5.893    ASO= 0.62
    THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.
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TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
39-Y - 90	1.027E+01	6.770E-01	1.716E+00	2.209E+00	0.0
39-Y - 91	1.050E+01	7.140E-01	8.362E-01	3.521E+00	7.200E-01
39-Y - 92	1.012E+01	7.629E-01	2.480E+00	3.191E+00	0.0
39-Y - 93	1.150E+01	8.053E-01	1.740E+00	5.854E+00	1.120E+00
40-ZR- 91	1.036E+01	8.000E-01	7.822E-01	5.057E+00	1.200E+00
40-ZR- 92	1.088E+01	8.192E-01	5.122E-01	6.429E+00	1.920E+00
40-ZR- 93	1.298E+01	7.000E-01	1.273E+00	5.183E+00	1.200E+00
40-ZR- 94	1.275E+01	7.530E-01	4.411E-01	7.019E+00	2.320E+00
41-NB- 92	1.040E+01	8.410E-01	4.607E+00	4.477E+00	0.0
41-NB- 93	1.250E+01	7.120E-01	2.205E+00	4.629E+00	7.200E-01
41-NB- 94	1.281E+01	7.230E-01	7.763E+00	4.250E+00	0.0
41-NB- 95	1.277E+01	7.500E-01	2.121E+00	5.782E+00	1.120E+00

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 7.400 FOR NB- 94 AND 3.625 FOR NB- 95.

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MAT number = 4131

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 41-NB- 95 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  NO RESOLVED RESONANCE PARAMETERS

  UNRESOLVED RESONANCE REGION : 25 EV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/2/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV. THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATIC OF
    MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.370E-4, S1 = 5.500E-4, S2 = 0.360E-4, SG = 33.8E-4,
    GG = 0.160 EV, R  = 6.700 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S                RES. INTEG.
      TOTAL         12.70                      -
      ELASTIC        5.700                     -
      CAPTURE        7.000                    41.8

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 25 EV, THE CAPTURE AND ELASTIC SCATTERING CROSS SECTIONS
  WERE ASSUMED TO BE IN 1/V FORM AND CONSTANT, RESPECTIVELY.
  THE CAPTURE CROSS SECTION AT 0.0253 EV WAS ADOPTED FROM REF./3/
  AND THE SCATTERING CROSS SECTION WAS CALCULATED FROM R = 6.7 FM.
  UNRESOLVED RESONANCE PARAMETERS WERE GIVEN IN THE ENERGY RANGE
  FROM 25 EV TO 100 KEV.

  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/4/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED BY IIJIMA AND KAWAI/5/ TO REPRODUCE A SYSTEMATIC
  TREND OF THE TOTAL CROSS SECTION.  THE OMP'S FOR CHARGED
  PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/6/
     ALPHA    = HUIZENGA AND IGO/7/
     DEUTERON = LOHR AND HAEBERLI/8/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/9/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/10/ WERE EVALUATED BY IIJIMA ET AL./11/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /12/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/13/ AND NUCLEAR DATA
    SHEETS/14/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0            9/2 +
            1        0.2357         1/2 -
            2        0.7242         7/2 +
            3        0.7280         3/2 +
            4        0.7567         7/2 +
            5        0.7990         1/2 -
            6        1.0000         5/2 -
            7        1.0880         7/2 -
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             8         1.2230          1/2 -
             9         1.2740          1/2 -
            10         1.4190          7/2 -
            11         1.5140          7/2 -
            12         1.5900          3/2 +
            13         1.6450          3/2 +
            14         1.6910          3/2 +
            15         1.8100          3/2 +
            16         1.9130          3/2 +
            17         1.9800          7/2 -
            18         2.0700          3/2 +
            19         2.1210          3/2 +
            20         2.1650          3/2 +
       LEVELS ABOVE 2.26 MEV WERE ASSUMED TO BE OVERLAPPING.

   MT = 102  CAPTURE
     SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
     CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
     SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
     AND REFFO/15/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

     THE GAMMA-RAY STRENGTH FUNCTION (3.26E-03) WAS DETERMINED FROM
     THE SYSTEMATICS OF RADIATION WIDTH (0.16 EV) AND THE AVERAGE
     S-WAVE RESONANCE LEVEL SPACING (49.1 EV) CALCULATED FROM THE
     LEVEL DENSITY PARAMETERS.

   MT = 16  (N,2N) CROSS SECTION
   MT = 17  (N,3N) CROSS SECTION
   MT = 22  (N,N'A) CROSS SECTION
   MT = 28  (N,N'P) CROSS SECTION
   MT = 32  (N,N'D) CROSS SECTION
   MT = 33  (N,N'T) CROSS SECTION
   MT =103  (N,P) CROSS SECTION
   MT =104  (N,D) CROSS SECTION
   MT =105  (N,T) CROSS SECTION
   MT =106  (N,HE3) CROSS SECTION
   MT =107  (N,ALPHA) CROSS SECTION
     THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
     PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

     THE KALBACH'S CONSTANT K (= 167.0) WAS ESTIMATED BY THE
     FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/16/ AND LEVEL
     DENSITY PARAMETERS.

     FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
     NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
       (N,P)          15.00  MB (SYSTEMATICS OF FORREST/17/)
       (N,ALPHA)       4.32  MB (SYSTEMATICS OF FORREST)

   MT = 251  MU-BAR
     CALCULATED WITH CASTHY.

 MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
   LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
   GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
   TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
   CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
   BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

 MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
   ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
   PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
   OTHER NEUTRON EMITTING REACTIONS.

 TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
          ----------------------  ------------  ---------------
         V  = 46.0-0.25E          R0 = 5.893    A0 = 0.62
         WS = 7.0                 RS = 6.393    AS = 0.35
         VSO= 7.0                 RSO= 5.893    ASO= 0.62
   THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

 TABLE 2  LEVEL DENSITY PARAMETERS

  NUCLIDE       A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
  ---------------------------------------------------------------
  39-Y - 91     1.050E+01 7.140E-01 8.362E-01 3.521E+00 7.200E-01
  39-Y - 92     1.012E+01 7.629E-01 2.480E+00 3.191E+00 0.0
  39-Y - 93     1.150E+01 8.053E-01 1.740E+00 5.854E+00 1.120E+00
  39-Y - 94     9.149E+00 7.385E-01 1.378E+00 2.222E+00 0.0
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40-ZR- 92	1.088E+01	8.192E-01	5.122E-01	6.429E+00	1.920E+00
40-ZR- 93	1.298E+01	7.000E-01	1.273E+00	5.183E+00	1.200E+00
40-ZR- 94	1.275E+01	7.530E-01	4.411E-01	7.019E+00	2.320E+00
40-ZR- 95	1.331E+01	6.070E-01	5.453E-01	3.985E+00	1.200E+00
41-NB- 93	1.250E+01	7.120E-01	2.205E+00	4.629E+00	7.200E-01
41-NB- 94	1.281E+01	7.230E-01	7.763E+00	4.250E+00	0.0
41-NB- 95	1.277E+01	7.500E-01	2.121E+00	5.782E+00	1.120E+00
41-NB- 96	1.331E+01	5.880E-01	3.406E+00	2.530E+00	0.0

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 3.625 FOR NB- 95 AND 5.0 FOR NB- 96.

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MAT number = 4200

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 42-MO-  0 JNDC,JAERI EVAL-MAR89 JNDC FPND W.G., M.MIZUMOTO
                      DIST-OCT89 REV2-FEB94
HISTORY
84-10 PHOTON PRODUCTION DATA WERE EVALUATED BY M.MIZUMOTO(JAERI).
89-03 FINAL DATA FOR JENDL-3 WERE COMPILED FROM ISOTOPE DATA.  THE
      ISOTOPE DATA WERE EVALUATED BY JNDC FP NUCLEAR DATA WORKING
      GROUP/1/.
90-10 MF=5: SPECTRA AT THRESHOLD ENERGIES WERE MODIFIED.
94-02 JENDL-3.2.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (3,2), (3,4), (3,51-91), (3,16), (3,17), (3,22), (3,28)
      (4,16-91)
      (5,16-91)
            THESE DATA WERE ADOPTED FROM JENDL FUSION FILE.
      (12,102)
     ***********************************************************

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      JENDL FUSION FILE /2/  (AS OF OCT. 1993)
        EVALUATED BY K.KOSAKO(NEDAC) AND S.CHIBA (NDC/JAERI)
        COMPILED BY K.KOSAKO

          THE INELASTIC SCATTERING, (N,2N), (N,3N), (N,NP), (N,NA)
        CROSS SECTIONS WERE CALCULATED WITH SINCROS-II SYSTEM/3/.
        THE OTHER CROSS SECTIONS WERE TAKEN FROM JENDL-3.1.  MF=6
        OF MT=16, 17, 22, 28 AND 91 WERE CREATED WITH F15TOB
        PROGRAM /2/ IN WHICH KUMABE'S SYSTEMATICS /4/ WAS USED.
        THE PRECOMPOUND/COMPOUND RATIO WAS CALCULATED BY THE
        SINCROS-II CODE SYSTEM/3/.
          OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED
        IN THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./3/.
        LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/5/.
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MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA)
    EVALUATED BY KIKUCHI ET AL./6/ ON THE BASIS OF THE FOLLOWING
    EXPERIMENTS.
     MO-92: BELOW 50 KEV
       TRANSMISSION : WASSON ET AL./7/
       CAPTURE      : WASSON ET AL./7/, WEIGMANN ET AL./8/,
                      MUSGROVE ET AL./9/
     MO-94: BELOW 20 KEV
       CAPTURE      : WEIGMANN ET AL./8/, MUSGROVE ET AL./9/
     MO-95: BELOW 2 KEV
       TRANSMISSION : SHWE ET AL./10/
       CAPTURE      : WEIGMANN ET AL./8/
     MO-96: BELOW 19 KEV
       CAPTURE      : WEIGMANN ET AL./8/, MUSGROVE ET AL./9/
     MO-97: BELOW 1.8 KEV
       TRANSMISSION : SHWE ET AL./10/
       CAPTURE      : WEIGMANN ET AL./8/
     MO-98: BELOW 32 KEV
       TRANSMISSION : CHRIEN ET AL./11/
       CAPTURE      : WEIGMANN ET AL./8/, MUSGROVE ET AL./9/
     MO-100: BELOW 26 KEV
       TRANSMISSION : WEIGMANN ET AL./12/
       CAPTURE      : WEIGMANN ET AL./8/, MUSGROVE ET AL./9/
    ASSUMED RADIATIVE WIDTHS(EV)
                 S-WAVE    P-WAVE             S-WAVE    P-WAVE
         MO-92   0.02      0.425      MO-94   0.135     0.175
         MO-95   0.150     0.180      MO-96   0.114     0.136
         MO-97   0.130     0.150      MO-98   0.085     0.12
         MO-100  0.065     0.08
  UNRESOLVED RESONANCE REGION : UP TO 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS WERE CALCULATED WITH OPTICAL
    MODEL CODE CASTHY/13/.  THE LEVEL SPACING WAS DETERMINED TO
    REPRODUCE THE CAPTURE CROSS SECTION CALCULATED WITH CASTHY.
    THE SCATTERING RADIUS WAS OBTAINED FROM FITTING TO THE
    CALCULATED TOTAL CROSS SECTION AT 100 KEV.

  TYPICAL VALUES OF THE AVERAGE PARAMETERS AT 70 KEV:
               S0        S1        S2        GG(EV)   D0(EV)  R(FM)
    MO-92   0.369E-4  5.479E-4  0.364E-4  0.226    2252    6.746
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MO-94	0.369E-4	5.479E-4	0.365E-4	0.230	1101	6.699
MO-95	0.369E-4	5.479E-4	0.365E-4	0.232	76.12	6.680
MO-96	0.370E-4	5.480E-4	0.365E-4	0.162	93.33	6.698
MO-97	0.370E-4	5.479E-4	0.365E-4	0.180	58.76	6.687
MO-98	0.370E-4	5.479E-4	0.364E-4	0.133	765.9	6.675
MO-100	0.370E-4	5.479E-4	0.365E-4	0.085	576.1	6.651

CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)

	2200 M/S	RES. INTEG.
TOTAL	8.066	-
ELASTIC	5.483	-
CAPTURE	2.582	25.68

MF = 3 NEUTRON CROSS SECTIONS
BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.

FOR JENDL-3.1, THE SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS PERFORMED WITH CASTHY/13/ IN THE ENERGY RANGE ABOVE 100 KEV, BY TAKING ACCOUNT OF COMPETING REACTIONS OF WHICH CROSS SECTIONS WERE CALCULATED WITH A PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS/14/. THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE DETERMINED BY IIJIMA ET AL./15/ TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS SECTION. THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
PROTON = PEREY/16/
ALPHA = HUIZENGA AND IGO/17/
DEUTERON = LOHR AND HAEBERLI/18/
HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/19/
PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GIRBERT AND CAMERON/20/ WERE EVALUATED BY IIJIMA ET AL./21/. MORE EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE PRESENT WORK. TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED IN THE PRESENT CALCULATION. THE ENERGY DEPENDENCE OF SPIN CUT-OFF PARAMETER IN THE ENERGY RANGE BELOW E-JOINT (EX) IS DUE TO GRUPPELAAR/22/.

FOR JENDL-3.2, DATA OF NEUTRON EMITTING REACTIONS WERE ADOPTED FROM JENDL FUSION FILE. THE THORETICAL CALCULATION WAS MADE WITH SINCROS-II SYSTEM/3/ BY ADOPTIG WALTER-GUSS OMP MODIFIED BY YAMAMURO/3/ FOR NEUTRONS, LEMOS OMP MODIFIED BY ARTHUR AND YOUNG/23/ FOR ALPHA, THE SAME OMP'S AS THE PEGASUS CALCULATION FOR OTHER CHARGED PARTICLES AND STANDARD LEVEL DENSITY PARAMETERS OF SINCROS-II SYSTEM.

THE DATA FOR MT=1, 102, 103, 104, 105, 106, 107, 11 AND 251 ARE THE SAME AS JENDL-3.1.

MT = 1 TOTAL
BELOW 500 KEV, SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED. OMP IN TABLE 1 AND CASTHY WERE USED. ABOVE 500 KEV, SPLINE-FITTING TO THE DATA MEASURED BY FOSTER AND GLASGOW /24/, LAMBROPOULOS ET AL./25/ AND POENITZ AND WHALEN/26/ WAS MADE.

MT = 2 ELASTIC SCATTERING
CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

MT = 4, 51 - 91 INELASTIC SCATTERING
TAKEN FROM JENDL FUSION FILE. THE INELASTIC SCATTERING CROSS SECTIONS FOR EACH ISOTOPE WERE GROUPED IN NATURAL MO DATA AS FOLLOWS:

MT	-Q(MEV)	MO-92	MO-94	MO-95	MO-96	MO-97	MO-98	MO-100
51	0.2041	-	-	51	-	-	-	-
52	0.4809	-	-	-	-	51	-	-
53	0.5356	-	-	-	-	-	-	51
54	0.6579	-	-	-	-	52,53	-	-
55	0.6944	-	-	-	-	-	-	52
56	0.7192	-	-	-	-	54,55	-	-
57	0.7348	-	-	-	-	-	51	-
58	0.7530	-	-	52	-	56	-	-
59	0.7820	-	-	53	51	57	52	-
60	0.8206	-	-	54	-	58	-	-
61	0.8711	-	51	-	-	59	-	-
62	0.9477	-	-	55	-	60	-	-
63	1.0245	-	-	56	-	61	-	-
64	1.0567	-	-	57,58	-	62	-	53
65	1.1168	-	-	-	52	63	-	54
66	1.3023	-	-	59,60	-	-	-	-
67	1.4257	-	-	61	-	-	53	-
68	1.4977	51	-	-	53	-	54	-
69	1.5408	-	52	62,63	-	-	-	-

70	1.6202	-	-	64,65	54,55	-	-	-
71	1.7425	-	53	-	-	-	55	-
72	1.8643	-	54	-	56	-	56	-
73	1.9650	-	-	-	57	-	57,58	-
74	2.0376	-	55	-	58	-	59,60	-
75	2.2063	-	-	-	59,60	-	61,62	-
76	2.2826	52	56	-	-	-	63,64	-
77	2.3932	-	57,58	-	61-63	-	-	-
78	2.4810	-	-	-	64	-	-	-
79	2.5015	53,54	-	-	65	-	-	-
80	2.5339	-	59,60	-	66	-	-	-
81	2.5943	55	61	-	67	-	-	-
82	2.7398	56	62,63	-	-	-	-	-
83	2.8058	57	64,65	-	-	-	-	-
84	2.8702	-	66,67	-	-	-	-	-
85	2.9558	58	68,69	-	-	-	-	-
86	3.0641	59,60	-	-	-	-	-	-
87	3.3691	61	-	-	-	-	-	-
88	3.5420	62,63	-	-	-	-	-	-
89	3.6212	64-66	-	-	-	-	-	-

OTHERS WERE SUMMED UP TO MT=91.

MT = 16, 17, 22, 28 (N,2N), (N,3N), (N,NA) AND (N,NP)
ADOPTED FROM JENDL FUSION FILE. NORMALIZATION OF THE RESULTS
WAS NOT MADE BECAUSE THE PARAMETERS USED WERE DETERMINED BY
YAMAMURO/27/ TO REPRODUCE WELL EXPERIMENTAL DATA.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
CASTHY/13/ WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS
SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
AND REFFO/28/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.
THE GAMMA-RAY STRENGTH FUNCTIONS WERE ADJUSTED TO REPRODUCE
THE CAPTURE CROSS SECTION MEASURED BY MUSGROVE ET AL./8/.
MO-92: 0.941E-4, MO-94: 1.966E-4, MO-95: 29.76E-4,
MO-96: 1.623E-4, MO-97: 29.76E-4, MO-98: 1.623E-4,
MO-100: 1.432E-4,

MT = 103,104,105,106,107,111
(N,P), (N,D), (N,T), (N,HE3), (N,ALPHA) AND (N,2P)
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH PEGASUS
/14/. THE KALBACH'S CONSTANTS WERE ESTIMATED BY THE FORMULA
DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/29/ AND LEVEL DENSITY
PARAMETERS. THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
NORMALIZED TO THE EXPERIMENTAL DATA OR SYSTEMATICS AT 14.5
MEV. FOR MORE DETAILS, SEE COMMENT OF EACH ISOTOPE.

MT = 251 MU-BAR
CALCULATED WITH CASTHY/13/.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
MT = 2
CALCULATED WITH CASTHY/13/ (SAME AS JENDL-3.1).
MT = 51-89
TAKEN FROM JENDL FUSION FILE WHICH WAS CALCULATED WITH CASTHY
AND DWUCKY IN THE SINCROS-II SYSTEM.
MT = 16,17,22,28,91
TRANSFORMED FROM MF=6 DATA (DDX) OF JENDL FUSION FILE.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
MT = 16,17,22,28,91
TRANSFORMED FROM MF=6 DATA (DDX) OF JENDL FUSION FILE.

MF =12 PHOTON PRODUCTION MULTIPLICITIES
MT = 102 (BELOW 420 KEV)
DETERMINED FROM ENERGY BALANCE.

MF =13 PHOTON PRODUCTION CROSS SECTIONS
MT = 3 (ABOVE 420 KEV)
FITTED WITH THE EMPIRICAL FORMULA BY HOWERTON AND PLECHATY
/30/ BASED ON THE EXPERIMENTAL DATA/31/.

MF =14 PHOTON ANGULAR DISTRIBUTIONS
MT = 3,102
ASSUMED TO BE ISOTROPIC.

MF =15 CONTINUOUS PHOTON ENERGY SPECTRA
MT = 3
FITTED WITH THE EMPIRICAL FORMULA BY HOWERTON AND PLECHATY
/30/ BASED ON THE EXPERIMENTAL DATA/31/, AND COMPARED WITH
EXPERIMENTAL DATA MEASURED BY YAMAMURO ET AL./32/.
MT = 102

CALCULATED WITH CASTHY/13/ FOR EACH ISOTOPE AND CONSTRUCTED ACCORDING TO THEIR ABUNDANCES.

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FOLLOWING ARE PARAMETERS USED IN THE CASTHY AND PEGASUS CALC.

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TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 46.0-0.25E	R0 = 5.893	A0 = 0.62
WS = 7.0	RS = 6.393	AS = 0.35
WSO= 7.0	RSO= 5.893	ASO= 0.62

TABLE 2 LEVEL DENSITY PARAMETERS

NUCL.	SYST	A(/MEV)	T(MEV)	C(/MEV)	EX(MEV)	PAIRING
40-ZR- 88	*	1.404E+01	7.386E-01	4.932E-01	7.870E+00	2.660E+00
40-ZR- 89		1.095E+01	8.260E-01	1.379E+00	5.864E+00	1.200E+00
40-ZR- 90		9.152E+00	8.222E-01	1.526E-01	5.383E+00	2.130E+00
40-ZR- 91		1.036E+01	8.000E-01	7.822E-01	5.057E+00	1.200E+00
40-ZR- 92		1.088E+01	8.192E-01	5.122E-01	6.429E+00	1.920E+00
40-ZR- 93		1.298E+01	7.000E-01	1.273E+00	5.183E+00	1.200E+00
40-ZR- 94		1.275E+01	7.530E-01	4.411E-01	7.019E+00	2.320E+00
40-ZR- 95		1.331E+01	6.070E-01	5.453E-01	3.985E+00	1.200E+00
40-ZR- 96		1.320E+01	7.000E-01	2.235E-01	6.589E+00	2.490E+00
40-ZR- 97		1.259E+01	5.590E-01	2.497E-01	3.084E+00	1.200E+00
40-ZR- 98	*	1.725E+01	6.633E-01	1.790E+00	7.555E+00	2.140E+00
40-ZR- 99	*	1.831E+01	6.566E-01	1.170E+01	6.957E+00	1.200E+00
41-NB- 89	*	1.420E+01	7.303E-01	2.467E+00	6.611E+00	1.460E+00
41-NB- 90	*	1.395E+01	7.222E-01	1.458E+01	4.869E+00	0.0
41-NB- 91	*	9.464E+00	7.143E-01	3.924E-01	3.082E+00	9.300E-01
41-NB- 92		1.040E+01	8.410E-01	4.607E+00	4.477E+00	0.0
41-NB- 93		1.250E+01	7.120E-01	2.205E+00	4.629E+00	7.200E-01
41-NB- 94		1.281E+01	7.230E-01	7.763E+00	4.250E+00	0.0
41-NB- 95		1.277E+01	7.500E-01	2.121E+00	5.782E+00	1.120E+00
41-NB- 96		1.331E+01	5.880E-01	3.406E+00	2.530E+00	0.0
41-NB- 97		1.337E+01	6.710E-01	9.771E-01	5.026E+00	1.290E+00
41-NB- 98		1.380E+01	5.110E-01	2.350E+00	1.731E+00	0.0
41-NB- 99	*	1.742E+01	6.566E-01	1.085E+01	6.300E+00	9.400E-01
41-NB-100	*	1.850E+01	6.500E-01	7.329E+01	5.699E+00	0.0
42-MO- 90	*	1.436E+01	7.222E-01	4.129E-01	7.834E+00	2.740E+00
42-MO- 91		1.168E+01	7.820E-01	1.284E+00	5.770E+00	1.280E+00
42-MO- 92		1.064E+01	7.770E-01	2.062E-01	5.938E+00	2.210E+00
42-MO- 93		1.125E+01	7.800E-01	9.792E-01	5.457E+00	1.280E+00
42-MO- 94		1.301E+01	6.850E-01	3.417E-01	5.770E+00	2.000E+00
42-MO- 95		1.360E+01	7.150E-01	1.847E+00	5.835E+00	1.280E+00
42-MO- 96		1.403E+01	7.410E-01	6.991E-01	7.645E+00	2.400E+00
42-MO- 97		1.517E+01	6.800E-01	2.769E+00	6.036E+00	1.280E+00
42-MO- 98		1.594E+01	6.900E-01	7.358E-01	7.888E+00	2.570E+00
42-MO- 99		1.774E+01	6.200E-01	4.294E+00	6.058E+00	1.280E+00
42-MO-100		1.780E+01	6.000E-01	6.702E-01	6.645E+00	2.220E+00
42-MO-101		2.085E+01	5.650E-01	7.153E+00	6.092E+00	1.280E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.
SPIN CUT-OFF PARAMS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).

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MAT number = 4225

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 42-MO- 92 JNDC       EVAL-AUG89 JNDC FP NUCLEAR DATA W.G.
                      DIST-OCT89 REV2-OCT93
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
89-08 MODIFICATION FOR JENDL-3 WAS MADE/2/.
90-10 MF=5: SPECTRA AT THRESHOLD ENERGIES WERE MODIFIED.
93-10 JENDL-3.2.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (3,2), (3,4), (3,51-91), (3,16), (3,22), (3,28)
      (4,16-91)
      (5,16-91)
            THESE DATA WERE ADOPTED FROM JENDL FUSION FILE
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      JENDL FUSION FILE /3/  (AS OF OCT. 1993)
        EVALUATED BY K.KOSAKO(NEDAC) AND S.CHIBA (NDC/JAERI)
        COMPILED BY K.KOSAKO

          THE INELASTIC SCATTERING, (N,2N), (N,NP), (N,NA) CROSS
        SECTIONS WERE CALCULATED WITH SINCROS-II SYSTEM/4/.  THE
        OTHER CROSS SECTIONS WERE TAKEN FROM JENDL-3.1.  MF=6 OF
        MT=16, 22, 28 AND 91 WERE CREATED WITH F15TOB PROGRAM /3/
        IN WHICH KUMABE'S SYSTEMATICS /5/ WAS USED.  THE PRECOM-
        POUND/COMPOUND RATIO WAS CALCULATED BY THE SINCROS-II
        CODE SYSTEM/4/.
          OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED
        IN THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./4/.
        LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/6/.
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MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 50 KEV
    RESONANCE PARAMETERS WERE EVALUATED BY KIKUCHI ET AL./7/ ON
    THE BASIS OF THE FOLLOWING EXPERIMENTS.
        TRANSMISSION : WASSON ET AL./8/
        CAPTURE      : WASSON ET AL./8/, WEIGMANN ET AL./9/,
                       MUSGROVE ET AL./10/
    AVERAGE RADIATIVE WIDTHS OF 0.02 EV FOR S-WAVE RES. AND 0.425
    EV FOR P-WAVE RES WERE ADOPTED.  SCATTERING RADIUS WAS TAKEN
    FROM MUGHABGHAB ET AL./11/
  UNRESOLVED RESONANCE REGION : 50 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/12/.  THE OBSERVED LEVEL
    SPACING WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS
    WAS OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS
    SECTION AT 100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.369E-4, S1 = 5.479E-4, S2 = 0.364 E-4, GG = 0.226 EV
    D0 = 2252  EV, R  = 6.746 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL          5.566                     -
      ELASTIC        5.545                     -
      CAPTURE        0.02075                 0.968

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.  ABOVE 100 KEV,
  THE SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
  PERFORMED WITH CASTHY/12/, BY TAKING ACCOUNT OF COMPETING
  REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED WITH
  PEGASUS/13/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED BY IIJIMA ET AL./14/ TO REPRODUCE A SYSTEMATIC TREND
  OF THE TOTAL CROSS SECTION.  THE OMP'S FOR CHARGED PARTICLES ARE
  AS FOLLOWS:
     PROTON   = PEREY/15/
     ALPHA    = HUIZENGA AND IGO/16/
     DEUTERON = LOHR AND HAEBERLI/17/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/18/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GIRBERT
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AND CAMERON/19/ WERE EVALUATED BY IIJIMA ET AL./20/.  MORE
EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
IN THE PRESENT CALCULATION.  THE ENERGY DEPENDENCE OF SPIN
CUT-OFF PARAMETER IN THE ENERGY RANGE BELOW E-JOINT (EX) IS DUE
TO GRUPPELAAR/21/.

   FOR JENDL-3.2, DATA OF NEUTRON EMITTING REACTIONS WERE
ADOPTED FROM JENDL FUSION FILE.  THE CALCULATION WAS MADE WITH
SINCROS-II SYSTEM/4/ BY ADOPTIG WALTER-GUSS OMP MODIFIED BY
YAMAMURO/4/ FOR NEUTRONS, LEMOS OMP MODIFIED BY ARTHUR AND
YOUNG/22/ FOR ALPHA, THE SAME OMP'S AS THE PEGASUS CALCULATION
FOR OTHER CHARGED PARTICLES AND STANDARD LEVEL DENSITY
PARAMETERS OF SINCROS-II SYSTEM.

MT = 1  TOTAL
  SPHERICAL OPTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED.

MT = 2  ELASTIC SCATTERING
  CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

MT = 4, 51 - 91  INELASTIC SCATTERING
  TAKEN FROM JENDL FUSION FILE.  THE LEVEL SCHEME WAS TAKEN FROM
  REF./6/  CNTRIBUTIONS OF THE DIRECT PROCESS WAS CALCULATED
  FOR THE LEVELS MARKED WITH '*'.

         NO.      ENERGY(MEV)    SPIN-PARITY
         GR.        0.0            0  +
          1         1.5095         2  +        *
          2         2.2826         4  +
          3         2.5197         0  +
          4         2.5271         5  -
          5         2.6124         6  +
          6         2.7604         8  +
          7         2.8497         3  -        *
          8         3.0070         5  -
          9         3.0641         4  -
         10         3.0913         2  +        *
         11         3.3691         4  +
         12         3.5420         2  +
         13         3.5803         3  -
         14         3.6212         4  +
         15         3.6248         7  -
         16         3.6880         4  +        *
    LEVELS ABOVE 3.688 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 16, 22, 28 (N,2N), (N,NA) AND (N,NP) CROSS SECTIONS
  ADOPTED FROM JENDL FUSION FILE.

MT = 102  CAPTURE
  SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
  CASTHY/12/ WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
  SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
  AND REFFO/23/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

  THE GAMMA-RAY STRENGTH FUNCTION (9.406E-05) WAS ADJUSTED TO
  REPRODUCE THE EXPERIMENTAL CAPTURE CROSS SECTION MEASURED BY
  MUSGROVE ET AL./9/.

MT =103  (N,P) CROSS SECTION
MT =104  (N,D) CROSS SECTION
MT =105  (N,T) CROSS SECTION
MT =106  (N,HE3) CROSS SECTION
MT =107  (N,ALPHA) CROSS SECTION
MT =111  (N,2P) CROSS SECTION
  THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
  PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE
  PEGASUS/13/.

  THE KALBACH'S CONSTANT K (= 251.4 ) WAS ESTIMATED BY THE
  FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/24/ AND LEVEL
  DENSITY PARAMETERS.

  FINALLY, (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO
  THE FOLLOWING VALUES AT 14.5 MEV:
    (N,P)          116  MB (SYSTEMATICS OF  FORREST/25/)
    (N,ALPHA)       24  MB (MEASURED BY IKEDA ET AL./26/)

MT = 251  MU-BAR
  CALCULATED WITH CASTHY/12/.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
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  MT = 2
    CALCULATED WITH CASTHY/12/.
  MT = 51-66
    TAKEN FROM JENDL FUSION FILE DATA WHICH WAS CALCULATED WITH
    CASTHY AND DWUCK/27/ IN THE SINCROS-II SYSTEM.
  MT = 16,22,28,91
    TRANSFORMED FROM MF=6 DATA (DDX) OF JENDL FUSION FILE.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT = 16,22,28,91
    TRANSFORMED FROM MF=6 DATA (DDX) OF JENDL FUSION FILE.

=================================================================
<<FOLLOWING ARE PARAMETERS USED IN THE CASTHY AND PEGASUS CALC.>>
=================================================================

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                 DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
          ----------------------  ------------   ---------------
          V  = 46.0-0.25E         R0 = 5.893     A0 = 0.62
          WS = 7.0                RS = 6.393     AS = 0.35
          WSO= 7.0                RSO= 5.893     ASO= 0.62

TABLE 2  LEVEL DENSITY PARAMETERS

 NUCL.    SYST A(/MEV)   T(MEV)    C(/MEV)   EX(MEV)   PAIRING
 ---------------------------------------------------------------
 40-ZR- 88   *  1.404E+01 7.386E-01 4.932E-01 7.870E+00 2.660E+00
 40-ZR- 89      1.095E+01 8.260E-01 1.379E+00 5.864E+00 1.200E+00
 40-ZR- 90      9.152E+00 8.222E-01 1.526E-01 5.383E+00 2.130E+00
 40-ZR- 91      1.036E+01 8.000E-01 7.822E-01 5.057E+00 1.200E+00

 41-NB- 89   *  1.420E+01 7.303E-01 2.467E+00 6.611E+00 1.460E+00
 41-NB- 90   *  1.395E+01 7.222E-01 1.458E+01 4.869E+00 0.0
 41-NB- 91   *  9.464E+00 7.143E-01 3.924E-01 3.082E+00 9.300E-01
 41-NB- 92      1.040E+01 8.410E-01 4.607E+00 4.477E+00 0.0

 42-MO- 90   *  1.436E+01 7.222E-01 4.129E-01 7.834E+00 2.740E+00
 42-MO- 91      1.168E+01 7.820E-01 1.284E+00 5.770E+00 1.280E+00
 42-MO- 92      1.064E+01 7.770E-01 2.062E-01 5.938E+00 2.210E+00
 42-MO- 93      1.125E+01 7.800E-01 9.792E-01 5.457E+00 1.280E+00
 ---------------------------------------------------------------
  SYST:  * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

  SPIN CUT-OFF PARAMS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
  IN THE CASTHY CALUCULATION, SPIN CUT-OFF FACTORS AT 0 MEV WERE
  ASSUMED TO BE 13.13 FOR MO-92 AND 5.000 FOR MO-93.
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MAT number = 4231

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 42-MO- 94 JNDC       EVAL-AUG89 JNDC FP NUCLEAR DATA W.G.
                      DIST-OCT89 REV2-OCT93
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
89-08 MODIFICATION FOR JENDL-3 WAS MADE/2/.
90-10 MF=5: SPECTRA AT THRESHOLD ENERGIES WERE MODIFIED.
93-10 JENDL-3.2.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (3,2), (3,4), (3,51-91), (3,16), (3,17), (3,22), (3,28)
      (4,16-91)
      (5,16-91)
            THESE DATA WERE ADOPTED FROM JENDL FUSION FILE
      (3,32)        DELETED
     ***********************************************************

     -------------------------------------------------------------
      JENDL FUSION FILE /3/  (AS OF OCT. 1993)
        EVALUATED BY K.KOSAKO(NEDAC) AND S.CHIBA (NDC/JAERI)
        COMPILED BY K.KOSAKO

          THE INELASTIC SCATTERING, (N,2N), (N,3N), (N,NP), (N,NA)
        CROSS SECTIONS WERE CALCULATED WITH SINCROS-II SYSTEM/4/.
        THE OTHER CROSS SECTIONS WERE TAKEN FROM JENDL-3.1.  MF=6
        OF MT=16, 17, 22, 28 AND 91 WERE CREATED WITH F15TOB
        PROGRAM /3/ IN WHICH KUMABE'S SYSTEMATICS/5/ WAS USED.
        THE PRECOMPOUND/COMPOUND RATIO WAS CALCULATED BY THE
        SINCROS-II CODE SYSTEM/4/.
          OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED
        IN THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./4/.
        LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/6/.
     -------------------------------------------------------------


MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 20 KEV
    EVALUATION WAS MADE BY KIKUCHI ET AL./7/ ON THE BASIS OF THE
    FOLLOWING EXPERIMENTAL DATA:
      CAPTURE : WEIGMANN ET AL./8/, MUSGROVE ET AL./9/
    AVERAGE RADIATIVE WIDTHS WERE ASSUMED TO BE 0.135 EV AND 0.175
    EV FOR S-WAVE AND P-WAVE RESONANCES, RESPECTIVELY.
  UNRESOLVED RESONANCE REGION : 20 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/10/.  THE OBSERVED LEVEL
    SPACING WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION
    AT 100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.369E-4, S1 = 5.479E-4, S2 = 0.365 E-4, GG = 0.230 EV
    D0 = 1101  EV, R  = 6.699 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           6.011                   -
      ELASTIC         5.998                   -
      CAPTURE         0.01311                 1.40

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.  ABOVE 100 KEV,
  THE SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
  PERFORMED WITH CASTHY/10/, BY TAKING ACCOUNT OF COMPETING
  REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED WITH
  PEGASUS/11/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED BY IIJIMA ET AL./12/ TO REPRODUCE A SYSTEMATIC TREND
  OF THE TOTAL CROSS SECTION.  THE OMP'S FOR CHARGED PARTICLES ARE
  AS FOLLOWS:
     PROTON   = PEREY/13/
     ALPHA    = HUIZENGA AND IGO/14/
     DEUTERON = LOHR AND HAEBERLI/15/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/16/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GIRBERT-
  CAMERON/17/ WERE EVALUATED BY IIJIMA ET AL./18/.  MORE EXTENSIVE
  DETERMINATION AND MODIFICATION WERE MADE IN THE PRESENT WORK.
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TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED IN THE PRESENT CALCULATION. THE ENERGY DEPENDENCE OF SPIN CUT-OFF PARAMETER IN THE ENERGY RANGE BELOW E-JOINT (EX) IS DUE TO GRUPPELAAR/19/.

FOR JENDL-3.2, DATA OF NEUTRON EMITTING REACTIONS WERE ADOPTED FROM JENDL FUSION FILE. THE CALCULATION WAS MADE WITH SINCROS-II SYSTEM/4/ BY ADOPTIG WALTER-GUSS OMP MODIFIED BY YAMAMURO/4/ FOR NEUTRONS, LEMOS OMP MODIFIED BY ARTHUR AND YOUNG/20/ FOR ALPHA, THE SAME OMP'S AS THE PEGASUS CALCULATION FOR OTHER CHARGED PARTICLES AND STANDARD LEVEL DENSITY PARAMETERS OF SINCROS-II SYSTEM.

MT = 1 TOTAL
SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

MT = 2 ELASTIC SCATTERING
CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

MT = 4, 51 - 91 INELASTIC SCATTERING
TAKEN FROM JENDL FUSION FILE. THE LEVEL SCHEME WAS TAKEN FROM REF./6/ CNTRIBUTIONS OF THE DIRECT PROCESS WAS CALCULATED FOR THE LEVELS MARKED WITH '*'.

NO.	ENERGY(MEV)	SPIN-PARITY	(DIRECT PROCESS)
GR.	0.0	0 +	
1	0.8711	2 +	*
2	1.5737	4 +	
3	1.7425	0 +	
4	1.8643	2 +	
5	2.0674	2 +	
6	2.2952	4 +	
7	2.3932	2 +	
8	2.4235	6 +	
9	2.5339	3 -	*
10	2.5668	4 +	
11	2.6115	5 -	
12	2.7398	1 +	
13	2.7681	4 +	
14	2.8058	2 +	
15	2.8359	3 +	
16	2.8702	2 +	
17	2.8724	6 +	
18	2.9558	8 +	
19	2.9651	2 +	

LEVELS ABOVE 2.965 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
ADOPTED FROM JENDL FUSION FILE.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY/10/ WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/21/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (=1.966E-4) WAS ADJUSTED TO REPRODUCE THE EXPERIMENTAL CAPTURE CROSS SECTION OF 54.5 MILLI-BARNS AT 100 KEV MEASURED BY MUSGROVE ET AL./9/.

MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =106 (N,HE3) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
MT =111 (N,2P) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PRE-EQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS /11/.

THE KALBACH'S CONSTANT K (= 151.7) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/22/ AND LEVEL DENSITY PARAMETERS.

FINALLY, (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,P)	55.10 MB	(SYSTEMATICS OF FORREST/23/)
(N,ALPHA)	17.50 MB	(RECOMMENDED BY FORREST/23/)

```
  MT = 251  MU-BAR
    CALCULATED WITH CASTHY/10/.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT = 2
    CALCULATED WITH CASTHY/12/.
  MT = 51-69
    TAKEN FROM JENDL FUSION FILE DATA WHICH WAS CALCULATED WITH
    CASTHY AND DWUCK/24/ IN THE SINCROS-II SYSTEM.
  MT = 16,17,22,28,91
    TRANSFORMED FROM MF=6 DATA (DDX) OF JENDL FUSION FILE.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT = 16,17,22,28,91
    TRANSFORMED FROM MF=6 DATA (DDX) OF JENDL FUSION FILE.

================================================================
<<FOLLOWING ARE PARAMETERS USED IN THE CASTHY AND PEGASUS CALC.>>
================================================================

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

               DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
          ----------------------  ------------  ---------------
          V  = 46.0-0.25E         R0 = 5.893    A0 = 0.62
          WS = 7.0                RS = 6.393    AS = 0.35
          WSO= 7.0                RSO= 5.893    ASO= 0.62

TABLE 2  LEVEL DENSITY PARAMETERS

 NUCL.    SYST A(/MEV)   T(MEV)    C(/MEV)   EX(MEV)   PAIRING
 ---------------------------------------------------------------
 40-ZR- 90     9.152E+00 8.222E-01 1.526E-01 5.383E+00 2.130E+00
 40-ZR- 91     1.036E+01 8.000E-01 7.822E-01 5.057E+00 1.200E+00
 40-ZR- 92     1.088E+01 8.192E-01 5.122E-01 6.429E+00 1.920E+00
 40-ZR- 93     1.298E+01 7.000E-01 1.273E+00 5.183E+00 1.200E+00

 41-NB- 91  *  9.464E+00 7.143E-01 3.924E-01 3.082E+00 9.300E-01
 41-NB- 92     1.040E+01 8.410E-01 4.607E+00 4.477E+00 0.0
 41-NB- 93     1.250E+01 7.120E-01 2.205E+00 4.629E+00 7.200E-01
 41-NB- 94     1.281E+01 7.230E-01 7.763E+00 4.250E+00 0.0

 42-MO- 92     1.064E+01 7.770E-01 2.062E-01 5.938E+00 2.210E+00
 42-MO- 93     1.125E+01 7.800E-01 9.792E-01 5.457E+00 1.280E+00
 42-MO- 94     1.301E+01 6.850E-01 3.417E-01 5.770E+00 2.000E+00
 42-MO- 95     1.360E+01 7.150E-01 1.847E+00 5.835E+00 1.280E+00
 ---------------------------------------------------------------
  SYST:  * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

  SPIN CUT-OFF PARAMS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
  IN THE CASTHY CALUCULATION, SPIN CUT-OFF FACTORS AT 0 MEV WERE
  ASSUMED TO BE 7.761 FOR MO-94 AND 6.184 FOR MO-95.
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MAT number = 4234

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 42-MO- 95 JNDC       EVAL-AUG89 JNDC FP NUCLEAR DATA W.G.
                      DIST-OCT89 REV2-OCT93
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
89-08 MODIFICATION FOR JENDL-3 WAS MADE/2/.
90-10 MF=5: SPECTRA AT THRESHOLD ENERGIES WERE MODIFIED.
93-10 JENDL-3.2.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (3,2), (3,4), (3,51-91), (3,16), (3,17), (3,22), (3,28)
      (4,16-91)
      (5,16-91)
            THESE DATA WERE ADOPTED FROM JENDL FUSION FILE
      (3,32)         DELETED
     ***********************************************************

     -------------------------------------------------------------
      JENDL FUSION FILE /3/  (AS OF OCT. 1993)
        EVALUATED BY K.KOSAKO(NEDAC) AND S.CHIBA (NDC/JAERI)
        COMPILED BY K.KOSAKO

          THE INELASTIC SCATTERING, (N,2N), (N,3N), (N,NP), (N,NA)
        CROSS SECTIONS WERE CALCULATED WITH SINCROS-II SYSTEM/4/.
        THE OTHER CROSS SECTIONS WERE TAKEN FROM JENDL-3.1.  MF=6
        OF MT=16, 17, 22, 28 AND 91 WERE CREATED WITH F15TOB
        PROGRAM /3/ IN WHICH KUMABE'S SYSTEMATICS /5/ WAS USED.
        THE PRECOMPOUND/COMPOUND RATIO WAS CALCULATED BY THE
        SINCROS- II CODE SYSTEM/4/.
          OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED
        IN THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./4/.
        LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/6/.
     -------------------------------------------------------------


MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 2 KEV
    EVALUATION WAS MADE BY KIKUCHI ET AL./7/ ON THE BASIS OF
    THE FOLLOWING EXPERIMENTAL DATA.
            TRANSMISSION : SHWE ET AL./8/
            CAPTURE      : WEIGMANN ET AL./9/
         ASSUMED GAM-G : 0.150 EV FOR S-WAVE AND 0.180 EV FOR
                         P-WAVE RESONANCE.
     A NEGATIVE RESONANCE WAS ADDED AT -20 EV.  VALUES OF TOTAL
     SPIN J WERE ASSUMED ARBITRARILY FOR LEVELS WHOSE J HAS NOT
     BEEN DETERMINED.
  UNRESOLVED RESONANCE REGION : 2 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/10/.  THE OBSERVED LEVEL
    SPACING WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.369E-4, S1 = 5.479E-4, S2 = 0.365 E-4, GG = 0.232  EV
    D0 = 76.12 EV, R  = 6.680 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                      2200 M/S                RES. INTEG.
      TOTAL          19.560                      -
      ELASTIC         5.566                      -
      CAPTURE          13.99                      119

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.  ABOVE 100 KEV,
  THE SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
  PERFORMED WITH CASTHY/6/, BY TAKING ACCOUNT OF COMPETING
  REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED WITH
  PEGASUS/11/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED BY IIJIMA ET AL./12/ TO REPRODUCE A SYSTEMATIC TREND
  OF THE TOTAL CROSS SECTION.  THE OMP'S FOR CHARGED PARTICLES ARE
  AS FOLLOWS:
     PROTON   = PEREY/13/
     ALPHA    = HUIZENGA AND IGO/14/
     DEUTERON = LOHR AND HAEBERLI/15/
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   HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/16/
PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GIRBERT
AND CAMERON/17/ WERE EVALUATED BY IIJIMA ET AL./18/.  MORE
EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
/19/.

   FOR JENDL-3.2, DATA OF NEUTRON EMITTING REACTIONS WERE
ADOPTED FROM JENDL FUSION FILE.  THE CALCULATION WAS MADE WITH
SINCROS-II SYSTEM/4/ BY ADOPTIG WALTER-GUSS OMP MODIFIED BY
YAMAMURO/4/ FOR NEUTRONS, LEMOS OMP MODIFIED BY ARTHUR AND
YOUNG/20/ FOR ALPHA, THE SAME OMP'S AS THE PEGASUS CALCULATION
FOR OTHER CHARGED PARTICLES AND STANDARD LEVEL DENSITY PARAME-
TERS OF SINCROS-II SYSTEM.

MT = 1  TOTAL
  SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

MT = 2  ELASTIC SCATTERING
  CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

MT = 4, 51 - 91  INELASTIC SCATTERING
  TAKEN FROM JENDL FUSION FILE.  THE LEVEL SCHEME WAS TAKEN FROM
  REF./6/  CNTRIBUTIONS OF THE DIRECT PROCESS WAS CALCULATED
  FOR THE LEVELS MARKED WITH '*'.

         NO.      ENERGY(MEV)    SPIN-PARITY (DIRECT PROCESS)
         GR.       0.0            5/2 +
          1        0.2041         3/2 +          *
          2        0.7658         7/2 +
          3        0.7862         1/2 +
          4        0.8206         3/2 +
          5        0.9477         9/2 +          *
          6        1.0392         1/2 +
          7        1.0567         3/2 +          *
          8        1.0737         7/2 +          *
          9        1.3023         1/2 +
         10        1.3697         3/2 +
         11        1.4257         3/2 +
         12        1.5408        11/2 +
         13        1.5517         7/2 +
         14        1.6202         3/2 +
         15        1.6451         7/2 +
    LEVELS ABOVE 1.645 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 16  (N,2N) CROSS SECTION
MT = 17  (N,3N) CROSS SECTION
MT = 22  (N,N'A) CROSS SECTION
MT = 28  (N,N'P) CROSS SECTION
  ADOPTED FROM JENDL FUSION FILE.

MT = 102  CAPTURE
  SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
  CASTHY/10/ WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
  SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
  AND REFFO/21/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

  THE GAMMA-RAY STRENGTH FUNCTION (2.976E-03) WAS ADJUSTED TO
  REPRODUCE THE EXPERIMENTAL CAPTURE CROSS SECTION OF 0.4 BARN
  AT 30 KEV MEASURED BY MUSGROVE ET AL./22/

MT =103  (N,P) CROSS SECTION
MT =104  (N,D) CROSS SECTION
MT =105  (N,T) CROSS SECTION
MT =106  (N,HE3) CROSS SECTION
MT =107  (N,ALPHA) CROSS SECTION
  THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
  PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE
  PEGASUS/11/.

  THE KALBACH'S CONSTANT K (= 142.6 ) WAS ESTIMATED BY THE
  FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/23/ AND LEVEL
  DENSITY PARAMETERS.

  FINALLY, (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO
  THE FOLLOWING VALUES AT 14.5 MEV:
    (N,P)          38.00  MB (RECOMMENDED BY FORREST/24/)
    (N,ALPHA)      13.50  MB (RECOMMENDED BY FORREST/24/)

MT = 251  MU-BAR
```

```
    CALCULATED WITH CASTHY/10/.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT = 2
    CALCULATED WITH CASTHY/10/.
  MT = 51-65
    TAKEN FROM JENDL FUSION FILE DATA WHICH WAS CALCULATED WITH
    CASTHY AND DWUCK/25/ IN THE SINCROS-II SYSTEM.
  MT = 16,17,22,28,91
    TRANSFORMED FROM MF=6 DATA (DDX) OF JENDL FUSION FILE.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT = 16,17,22,28,91
    TRANSFORMED FROM MF=6 DATA (DDX) OF JENDL FUSION FILE.


=================================================================
<<FOLLOWING ARE PARAMETERS USED IN THE CASTHY AND PEGASUS CALC.>>
=================================================================

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

               DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
         ----------------------  ------------  ---------------
        V  = 46.0-0.25E          R0 = 5.893    A0 = 0.62
        WS = 7.0                 RS = 6.393    AS = 0.35
        WSO= 7.0                 RSO= 5.893    ASO= 0.62

TABLE 2  LEVEL DENSITY PARAMETERS

  NUCLIDE      A(/MEV)   T(MEV)    C(/MEV)   EX(MEV)   PAIRING
 ---------------------------------------------------------------
 40-ZR- 91     1.036E+01 8.000E-01 7.822E-01 5.057E+00 1.200E+00
 40-ZR- 92     1.088E+01 8.192E-01 5.122E-01 6.429E+00 1.920E+00
 40-ZR- 93     1.298E+01 7.000E-01 1.273E+00 5.183E+00 1.200E+00
 40-ZR- 94     1.275E+01 7.530E-01 4.411E-01 7.019E+00 2.320E+00

 41-NB- 92     1.040E+01 8.410E-01 4.607E+00 4.477E+00 0.0
 41-NB- 93     1.250E+01 7.120E-01 2.205E+00 4.629E+00 7.200E-01
 41-NB- 94     1.281E+01 7.230E-01 7.763E+00 4.250E+00 0.0
 41-NB- 95     1.277E+01 7.500E-01 2.121E+00 5.782E+00 1.120E+00

 42-MO- 93     1.125E+01 7.800E-01 9.792E-01 5.457E+00 1.280E+00
 42-MO- 94     1.301E+01 6.850E-01 3.417E-01 5.770E+00 2.000E+00
 42-MO- 95     1.360E+01 7.150E-01 1.847E+00 5.835E+00 1.280E+00
 42-MO- 96     1.403E+01 7.410E-01 6.991E-01 7.645E+00 2.400E+00
 ---------------------------------------------------------------

  SPIN CUT-OFF PARAMS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
  IN THE CASTHY CALUCULATION, SPIN CUT-OFF FACTORS AT 0 MEV WERE
  ASSUMED TO BE 6.184 FOR MO-95 AND 7.696 FOR MO-96.

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    AND APPLIED SCIENCE, SANTA FE., VOL. 2, P.1627 (1985).
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REACTIONS", NORTH HOLLAND (1968).
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MAT number = 4237

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 42-MO- 96 JNDC       EVAL-AUG89 JNDC FP NUCLEAR DATA W.G.
                      DIST-OCT89 REV2-OCT93
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
89-08 MODIFICATION FOR JENDL-3 WAS MADE/2/.
90-10 MF=5: SPECTRA AT THRESHOLD ENERGIES WERE MODIFIED.
93-10 JENDL-3.2.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (3,2), (3,4), (3,51-91), (3,16), (3,17), (3,22), (3,28)
      (4,16-91)
      (5,16-91)
            THESE DATA WERE ADOPTED FROM JENDL FUSION FILE
      (3,32)        DELETED
     ***********************************************************

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      JENDL FUSION FILE /3/  (AS OF OCT. 1993)
        EVALUATED BY K.KOSAKO(NEDAC) AND S.CHIBA (NDC/JAERI)
        COMPILED BY K.KOSAKO

          THE INELASTIC SCATTERING, (N,2N), (N,3N), (N,NP), (N,NA)
        CROSS SECTIONS WERE CALCULATED WITH SINCROS-II SYSTEM /4/.
        THE OTHER CROSS SECTIONS WERE TAKEN FROM JENDL-3.1.  MF=6
        OF MT=16, 17, 22, 28 AND 91 WERE CREATED WITH F15TOB
        PROGRAM /3/ IN WHICH KUMABE'S SYSTEMATICS /5/ WAS USED.
        THE PRECOMPOUND/COMPOUND RATIO WAS CALCULATED BY THE
        SINCROS-II CODE SYSTEM/4/.
          OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED
        IN THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./4/.
        LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/6/.
     -------------------------------------------------------------


MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 19 KEV
    EVALUATION WAS MADE BY KIKUCHI ET AL./7/
      CAPTURE : WEIGMANN ET AL./8/, MUSGROVE ET AL./9/
    AVERAGE RADIATIVE WIDTHS WERE ASSUMED TO BE 0.114 EV AND 0.136
    EV FOR S-WAVE AND P-WAVE RESONANCES, RESPECTIVELY.
  UNRESOLVED RESONANCE REGION : 19 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/10/.  THE OBSERVED LEVEL
    SPACING WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.370E-4, S1 = 5.480E-4, S2 = 0.365E-4, GG = 0.162 EV
    D0 = 93.33 EV, R  = 6.698 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                    2200 M/S                 RES. INTEG.
      TOTAL          5.322                      -
      ELASTIC        4.727                      -
      CAPTURE        0.5954                    17.5

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.  ABOVE 100 KEV,
  THE SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
  PERFORMED WITH CASTHY/10/, BY TAKING ACCOUNT OF COMPETING
  REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED WITH
  PEGASUS/11/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED BY IIJIMA ET AL./12/ TO REPRODUCE A SYSTEMATIC TREND
  OF THE TOTAL CROSS SECTION.  THE OMP'S FOR CHARGED PARTICLES ARE
  AS FOLLOWS:
     PROTON   = PEREY/13/
     ALPHA    = HUIZENGA AND IGO/14/
     DEUTERON = LOHR AND HAEBERLI/15/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/16/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GIRBERT
  AND CAMERON/17/ WERE EVALUATED BY IIJIMA ET AL./18/.  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
```

IN THE PRESENT CALCULATION. ENERGY DEPENDENCE OF SPIN CUT-OFF PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR /19/.

FOR JENDL-3.2, DATA OF NEUTRON EMITTING REACTIONS WERE ADOPTED FROM JENDL FUSION FILE. THE CALCULATION WAS MADE WITH SINCROS-II SYSTEM/4/ BY ADOPTIG WALTER-GUSS OMP MODIFIED BY YAMAMURO/4/ FOR NEUTRONS, LEMOS OMP MODIFIED BY ARTHUR AND YOUNG/20/ FOR ALPHA, THE SAME OMP'S AS THE PEGASUS CALCULATION FOR OTHER CHARGED PARTICLES AND STANDARD LEVEL DENSITY PARAMETERS OF SINCROS-II SYSTEM.

MT = 1 TOTAL
SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

MT = 2 ELASTIC SCATTERING
CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

MT = 4, 51 - 91 INELASTIC SCATTERING
TAKEN FROM JENDL FUSION FILE. THE LEVEL SCHEME WAS TAKEN FROM REF./6/ CNTRIBUTIONS OF THE DIRECT PROCESS WAS CALCULATED FOR THE LEVELS MARKED WITH '*'.

NO.	ENERGY(MEV)	SPIN-PARITY	(DIRECT PROCESS)
GR.	0.0	0 +	
1	0.7782	2 +	*
2	1.1479	0 +	
3	1.4977	2 +	
4	1.6259	2 +	
5	1.6281	4 +	
6	1.8695	4 +	
7	1.9784	3 +	
8	2.0956	2 +	
9	2.2193	4 +	
10	2.2345	3 -	*
11	2.4261	3 +	
12	2.4384	5 +	
13	2.4406	6 +	
14	2.4810	2 +	
15	2.5015	1 +	
16	2.5404	3 +	
17	2.5943	3 +	

LEVELS ABOVE 2.594 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
ADOPTED FROM JENDL FUSION FILE.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY/10/ WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/21/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (1.623E-04) WAS ADJUSTED TO REPRODUCE THE EXPERIMENTAL CAPTURE CROSS SECTION MEASURED BY MUSGROVE ET AL./9/

MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS/11/.

THE KALBACH'S CONSTANT K (=116.4) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/22/ AND LEVEL DENSITY PARAMETERS.

FINALLY, (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,P)	23.00 MB	(MEASURED BY IKEDA ET AL./23/)
(N,ALPHA)	10.00 MB	(RECOMMENDED BY FORREST/24/)

MT = 251 MU-BAR
CALCULATED WITH CASTHY/10/.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
MT = 2

```
    CALCULATED WITH CASTHY/10/.
  MT = 51-67
    TAKEN FROM JENDL FUSION FILE DATA WHICH WAS CALCULATED WITH
    CASTHY AND DWUCK/25/ IN THE SINCROS-II SYSTEM.
  MT = 16,17,22,28,91
    TRANSFORMED FROM MF=6 DATA (DDX) OF JENDL FUSION FILE.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT = 16,17,22,28,91
    TRANSFORMED FROM MF=6 DATA (DDX) OF JENDL FUSION FILE.

=================================================================
<<FOLLOWING ARE PARAMETERS USED IN THE CASTHY AND PEGASUS CALC.>>
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TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
         ----------------------   ------------  ---------------
         V  = 46.0-0.25E          R0 = 5.893    A0 = 0.62
         WS = 7.0                 RS = 6.393    AS = 0.35
         WSO= 7.0                 RSO= 5.893    ASO= 0.62

TABLE 2  LEVEL DENSITY PARAMETERS

 NUCLIDE       A(/MEV)   T(MEV)    C(/MEV)   EX(MEV)   PAIRING
 ---------------------------------------------------------------
 40-ZR- 92     1.088E+01 8.192E-01 5.122E-01 6.429E+00 1.920E+00
 40-ZR- 93     1.298E+01 7.000E-01 1.273E+00 5.183E+00 1.200E+00
 40-ZR- 94     1.275E+01 7.530E-01 4.411E-01 7.019E+00 2.320E+00
 40-ZR- 95     1.331E+01 6.070E-01 5.453E-01 3.985E+00 1.200E+00

 41-NB- 93     1.250E+01 7.120E-01 2.205E+00 4.629E+00 7.200E-01
 41-NB- 94     1.281E+01 7.230E-01 7.763E+00 4.250E+00 0.0
 41-NB- 95     1.277E+01 7.500E-01 2.121E+00 5.782E+00 1.120E+00
 41-NB- 96     1.331E+01 5.880E-01 3.406E+00 2.530E+00 0.0

 42-MO- 94     1.301E+01 6.850E-01 3.417E-01 5.770E+00 2.000E+00
 42-MO- 95     1.360E+01 7.150E-01 1.847E+00 5.835E+00 1.280E+00
 42-MO- 96     1.403E+01 7.410E-01 6.991E-01 7.645E+00 2.400E+00
 42-MO- 97     1.517E+01 6.800E-01 2.769E+00 6.036E+00 1.280E+00
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  SPIN CUT-OFF PARAMS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
  IN THE CASTHY CALUCULATION, SPIN CUT-OFF FACTORS AT 0 MEV WERE
  ASSUMED TO BE 7.696 FOR MO- 96 AND 7.075 FOR MO- 97.
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MAT number = 4240

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 42-MO- 97 JNDC       EVAL-AUG89 JNDC FP NUCLEAR DATA W.G.
                      DIST-DEC89 REV2-OCT93
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
89-08 MODIFICATION FOR JENDL-3 WAS MADE/2/.
90-10 MF=5: SPECTRA AT THRESHOLD ENERGIES WERE MODIFIED.
93-10 JENDL-3.2.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (3,2), (3,4), (3,51-91), (3,16), (3,17), (3,22), (3,28)
      (4,16-91)
      (5,16-91)
            THESE DATA WERE ADOPTED FROM JENDL FUSION FILE
      (3,32)        DELETED
     ***********************************************************

     -------------------------------------------------------------
      JENDL FUSION FILE /3/  (AS OF OCT. 1993)
        EVALUATED BY K.KOSAKO(NEDAC) AND S.CHIBA (NDC/JAERI)
        COMPILED BY K.KOSAKO

          THE INELASTIC SCATTERING, (N,2N), (N,3N), (N,NP), (N,NA)
        CROSS SECTIONS WERE CALCULATED WITH SINCROS-II SYSTEM /4/.
        THE OTHER CROSS SECTIONS WERE TAKEN FROM JENDL-3.1.  MF=6
        OF MT=16, 17, 22, 28 AND 91 WERE CREATED WITH F15TOB
        PROGRAM /3/ IN WHICH KUMABE'S SYSTEMATICS /5/ WAS USED.
        THE PRECOMPOUND/COMPOUND RATIO WAS CALCULATED BY THE
        SINCROS-II CODE SYSTEM/4/.
          OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED
        IN THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./4/.
        LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/6/.
     -------------------------------------------------------------


MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 1.8 KEV
    EVALUATION WAS MADE BY KIKUCHI ET AL./7/ ON THE BASIS OF THE
    FOLLOWING EXPERIMENTAL DATA.
            TRANSMISSION : SHWE ET AL./8/
            CAPTURE      : WEIGMANN ET AL./9/
         ASSUMED GAMMA-G : 0.130 EV FOR S-WAVE AND 0.150 EV FOR
                           P-WAVE RESONANCES.
    A NEGATIVE RESONANCE ADDED AT -20 EV.  VALUES OF TOTAL SPIN J
    WERE ASSUMED ARBITRARILY FOR LEVELS WHOSE J HAS NOT BEEN
    DETERMINED.
  UNRESOLVED RESONANCE REGION : 1.8 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/10/.  THE OBSERVED LEVEL
    SPACING WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.370E-4, S1 = 5.479E-4, S2 = 0.365E-4, GG = 0.180 EV
    D0 = 58.76 EV, R  = 6.687 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           7.957                    -
      ELASTIC         5.857                    -
      CAPTURE         2.100                   17.1

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.  ABOVE 100 KEV,
  THE SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
  PERFORMED WITH CASTHY/10/, BY TAKING ACCOUNT OF COMPETING
  REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED WITH
  PEGASUS/11/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED BY IIJIMA ET AL./12/ TO REPRODUCE A SYSTEMATIC TREND
  OF THE TOTAL CROSS SECTION.  THE OMP'S FOR CHARGED PARTICLES ARE
  AS FOLLOWS:
     PROTON   = PEREY/13/
     ALPHA    = HUIZENGA AND IGO/14/
     DEUTERON = LOHR AND HAEBERLI/15/
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HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/16/
PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GIRBERT AND CAMERON/17/ WERE EVALUATED BY IIJIMA ET AL./18/. MORE EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE PRESENT WORK. TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED IN THE PRESENT CALCULATION. ENERGY DEPENDENCE OF SPIN CUT-OFF PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR /19/.

FOR JENDL-3.2, DATA OF NEUTRON EMITTING REACTIONS WERE ADOPTED FROM JENDL FUSION FILE. THE CALCULATION WAS MADE WITH SINCROS-II SYSTEM/4/ BY ADOPTIG WALTER-GUSS OMP MODIFIED BY YAMAMURO/4/ FOR NEUTRONS, LEMOS OMP MODIFIED BY ARTHUR AND YOUNG/20/ FOR ALPHA, THE SAME OMP'S AS THE PEGASUS CALCULATION FOR OTHER CHARGED PARTICLES AND STANDARD LEVEL DENSITY PARAMETERS OF SINCROS-II SYSTEM.

MT = 1 TOTAL
SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

MT = 2 ELASTIC SCATTERING
CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

MT = 4, 51 - 91 INELASTIC SCATTERING
TAKEN FROM JENDL FUSION FILE. THE LEVEL SCHEME WAS TAKEN FROM REF./6/ CNTRIBUTIONS OF THE DIRECT PROCESS WAS CALCULATED FOR THE LEVELS MARKED WITH '*'.

NO.	ENERGY(MEV)	SPIN-PARITY	(DIRECT PROCESS)
GR.	0.0	5/2 +	
1	0.4809	3/2 +	*
2	0.6579	7/2 +	
3	0.6796	1/2 +	*
4	0.7192	5/2 +	*
5	0.7208	3/2 +	
6	0.7530	5/2 +	
7	0.7950	1/2 +	
8	0.8409	3/2 +	
9	0.8881	1/2 +	
10	0.9930	5/2 +	
11	1.0245	7/2 +	*
12	1.0928	3/2 +	
13	1.1168	9/2 +	*

LEVELS ABOVE 1.117 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
ADOPTED FROM JENDL FUSION FILE.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY/10/ WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/21/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (2.976E-03) WAS ADJUSTED TO REPRODUCE THE EXPERIMENTAL CAPTURE CROSS SECTION MEASURED BY MUSGROVE ET AL./22/

MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =106 (N,HE3) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS/11/.

THE KALBACH'S CONSTANT K (=103.4) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/23/ AND LEVEL DENSITY PARAMETERS.

FINALLY, (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,P)	17.00 MB	(MEASURED BY IKEDA ET AL./24/)
(N,ALPHA)	7.50 MB	(RECOMMENDED BY FORREST/25/)

MT = 251 MU-BAR
CALCULATED WITH CASTHY/10/.

```
MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT = 2
    CALCULATED WITH CASTHY/10/.
  MT = 51-63
    TAKEN FROM JENDL FUSION FILE DATA WHICH WAS CALCULATED WITH
    CASTHY AND DWUCK/26/ IN THE SINCROS-II SYSTEM.
  MT = 16,17,22,28,91
    TRANSFORMED FROM MF=6 DATA (DDX) OF JENDL FUSION FILE.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT = 16,17,22,28,91
    TRANSFORMED FROM MF=6 DATA (DDX) OF JENDL FUSION FILE.


=================================================================
<<FOLLOWING ARE PARAMETERS USED IN THE CASTHY AND PEGASUS CALC.>>
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TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
         ----------------------   ------------  ---------------
        V  = 46.0-0.25E           R0 = 5.893    A0 = 0.62
        WS = 7.0                  RS = 6.393    AS = 0.35
        WSO= 7.0                  RSO= 5.893    ASO= 0.62

TABLE 2  LEVEL DENSITY PARAMETERS

 NUCLIDE       A(/MEV)   T(MEV)    C(/MEV)   EX(MEV)   PAIRING
 ---------------------------------------------------------------
 40-ZR- 93     1.298E+01 7.000E-01 1.273E+00 5.183E+00 1.200E+00
 40-ZR- 94     1.275E+01 7.530E-01 4.411E-01 7.019E+00 2.320E+00
 40-ZR- 95     1.331E+01 6.070E-01 5.453E-01 3.985E+00 1.200E+00
 40-ZR- 96     1.320E+01 7.000E-01 2.235E-01 6.589E+00 2.490E+00

 41-NB- 94     1.281E+01 7.230E-01 7.763E+00 4.250E+00 0.0
 41-NB- 95     1.277E+01 7.500E-01 2.121E+00 5.782E+00 1.120E+00
 41-NB- 96     1.331E+01 5.880E-01 3.406E+00 2.530E+00 0.0
 41-NB- 97     1.337E+01 6.710E-01 9.771E-01 5.026E+00 1.290E+00

 42-MO- 95     1.360E+01 7.150E-01 1.847E+00 5.835E+00 1.280E+00
 42-MO- 96     1.403E+01 7.410E-01 6.991E-01 7.645E+00 2.400E+00
 42-MO- 97     1.517E+01 6.800E-01 2.769E+00 6.036E+00 1.280E+00
 42-MO- 98     1.594E+01 6.900E-01 7.358E-01 7.888E+00 2.570E+00
 ---------------------------------------------------------------

  SPIN CUTOFF PARAMS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
  IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
  ASSUMED TO BE 7.075 FOR MO- 97 AND 5.291 FOR MO- 98.
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MAT number = 4243

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 42-MO- 98 JNDC       EVAL-AUG89 JNDC FP NUCLEAR DATA W.G.
                      DIST-SEP90 REV2-OCT93
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
89-08 MODIFICATION FOR JENDL-3 WAS MADE/2/.
90-02 (N,ALPHA) CROSS SECTION WAS MODIFIED.
90-10 MF=5: SPECTRA AT THRESHOLD ENERGIES WERE MODIFIED.
93-10 JENDL-3.2.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)       UNRESOLVED RESONANCE PARAMETERS
      (3,1)         CALCULATED FROM NEW OPTICAL POTENTIAL
      (3,4), (3,51-91), (3,16), (3,17), (3,22), (3,28)
                    TAKEN FROM JENDL FUSION FILE
      (3,32)        DELETED
      (4,16-91)     TAKEN FROM JENDL FUSION FILE
      (5,16-91)     TAKEN FROM JENDL FUSION FILE
     ***********************************************************

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      JENDL FUSION FILE /3/  (AS OF OCT. 1993)
        EVALUATED BY K.KOSAKO(NEDAC) AND S.CHIBA (NDC/JAERI)
        COMPILED BY K.KOSAKO

          THE INELASTIC SCATTERING, (N,2N), (N,3N), (N,NP), (N,NA)
        CROSS SECTIONS WERE CALCULATED WITH SINCROS-II SYSTEM /4/.
        THE OTHER CROSS SECTIONS WERE TAKEN FROM JENDL-3.1.  MF=6
        OF MT=16, 17, 22, 28 AND 91 WERE CREATED WITH F15TOB
        PROGRAM /3/ IN WHICH KUMABE'S SYSTEMATICS /5/ WAS USED.
        THE PRECOMPOUND/COMPOUND RATIO WAS CALCULATED BY THE
        SINCROS-II CODE SYSTEM/4/.
          OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED
        IN THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./4/.
        LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/6/.
     ------------------------------------------------------------


MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 32 KEV
    PARAMETERS WERE TAKEN FROM JENDL-2 WHICH WAS EVALUATED BY
    KIKUCHI ET AL./7/ ON THE BASIS OF THE FOLLOWING EXPERIMENTAL
    DATA.
       TRANSMISSION : CHRIEN ET AL./8/
       CAPTURE      : WEIGMANN ET AL./9/, MUSGROVE ET AL./10/
    AVERAGE RADIATION WIDTHS OF 0.085 EV AND 0.12 EV WERE ADOPTED
    TO S-WAVE AND P-WAVE RESONANCES, RESPECTIVELY.  A NEGATIVE
    RESONANCE WAS ADDED AT -980 EV SO AS TO REPRODUCE THE THERMAL
    CAPTURE CROSS SECTION GIVEN IN REF./11/.  SCATTERING RADIUS
    WAS TAKEN FROM THE COMPILATION BY MUGHABGHAB ET AL./11/

  UNRESOLVED RESONANCE REGION : 32 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/12/.  THE OBSERVED LEVEL
    SPACING WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.370E-4, S1 = 5.48E-4, S2 = 0.365E-4, SG = 1.74E-4,
    GG = 0.133 EV, R  = 6.631 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           5.772                   -
      ELASTIC         5.642                   -
      CAPTURE         0.1300                   6.56

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/13/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1(A)
  WERE DETERMINED BY IIJIMA AND KAWAI/14/ TO REPRODUCE A SYSTEMA-
```

TIC TREND OF THE TOTAL CROSS SECTION. THIS SET WAS USED FOR CALCULATION OF THE CAPTURE CROSS SECTION WITH CASTHY AND THE PEGASUS CALCULATION, AND ANGULAR DISTRIBUTIONS OF ELASTICALLY SCATTERED NEUTRONS. ANOTHER SET OF PARAMETERS IN TABLE 1(B) WAS DETEMINED BY WATANABE/15/ TO FIT BETTER THE MEASUED TOTAL CROSS SECTION, AND WAS USED FOR THE TOTAL CROSS SECTION CALCULATION FOR JENDL-3.2. THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:

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   PROTON   = PEREY/16/
   ALPHA    = HUIZENGA AND IGO/17/
   DEUTERON = LOHR AND HAEBERLI/18/
   HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/19/
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PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT AND CAMERON/20/ WERE EVALUATED BY IIJIMA ET AL./21/ MORE EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE PRESENT WORK. TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED IN THE PRESENT CALCULATION. ENERGY DEPENDENCE OF SPIN CUT-OFF PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR /22/.

FOR JENDL-3.2, THE INELASTIC SCATTERING, (N,2N), (N,3N), (N,NP), (N,NA) CROSS SECTIONS WERE ADOPTED FROM JENDL FUSION FILE. THE CALCULATION WAS MADE WITH SINCROS-II SYSTEM/4/ BY ADOPTIG WALTER-GUSS OMP MODIFIED BY YAMAMURO/4/ FOR NEUTRONS, LEMOS OMP MODIFIED BY ARTHUR AND YOUNG/23/ FOR ALPHA, THE SAME OMP'S AS THE PEGASUS CALCULATION FOR OTHER CHARGED PARTICLES AND STANDARD LEVEL DENSITY PARAME- TERS OF SINCROS-II SYSTEM.

MT = 1 TOTAL
  SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED. OPTICAL POTENTIAL PARAMETERS ARE GIVEN IN TABLE 1(B).

MT = 2 ELASTIC SCATTERING
  CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

MT = 4, 51 - 91 INELASTIC SCATTERING
  TAKEN FROM JENDL FUSION FILE. THE LEVEL SCHEME WAS TAKEN FROM REF./6/ CNTRIBUTIONS OF THE DIRECT PROCESS WAS CALCULATED FOR THE LEVELS MARKED WITH '*'.

NO.	ENERGY(MEV)	SPIN-PARITY	(DIRECT PROCESS)
GR.	0.0	0 +	
1	0.7348	0 +	
2	0.7874	2 +	*
3	1.4323	2 +	
4	1.5100	4 +	
5	1.7585	2 +	
6	1.8809	4 +	
7	1.9650	4 +	
8	2.0175	3 -	*
9	2.0376	0 +	
10	2.1048	2 +	
11	2.2063	2 +	
12	2.2238	4 +	
13	2.3334	2 +	*
14	2.3436	6 +	

LEVELS ABOVE 2.344 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
  ADOPTED FROM JENDL FUSION FILE.

MT = 102 CAPTURE
  SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. OPTICAL POTENTIAL PARAMETERS ARE LISTED IN TABLE 1(A). DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/24/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

  THE GAMMA-RAY STRENGTH FUNCTION (1.62E-04) WAS ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION MEASURED BY MUSGROVE ET AL./10/

MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
  THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

  THE KALBACH'S CONSTANT K (=77.4) WAS ESTIMATED BY THE FORMULA

```
    DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/25/ AND LEVEL DENSITY
    PARAMETERS.

    FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,P)          5.80  MB (MEASURED BY IKEDA ET AL./26/)
      (N,ALPHA)      5.70  MB (MEASURED BY IKEDA ET AL.)
    THE (N,ALPHA) CROSS SECTION WAS MODIFIED A LITTLE BY EYE-
    GUIDING THE EXPERIMENTAL DATA OF RAHMAN ET AL./27/ AND OF
    IKEDA ET AL./26/

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT = 2
    CALCULATED WITH CASTHY/12/ AND OMP IN TABLE 1(A).
  MT = 51-64
    TAKEN FROM JENDL FUSION FILE DATA WHICH WAS CALCULATED WITH
    CASTHY AND DWUCK/28/ IN THE SINCROS-II SYSTEM.
  MT = 16,17,22,28,91
    TRANSFORMED FROM MF=6 DATA (DDX) OF JENDL FUSION FILE.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT = 16,17,22,28,91
    TRANSFORMED FROM MF=6 DATA (DDX) OF JENDL FUSION FILE.


=================================================================
<<FOLLOWING ARE PARAMETERS USED IN THE CASTHY AND PEGASUS CALC.>>
=================================================================

TABLE 1(A)  NEUTRON OPTICAL POTENTIAL PARAMETERS

                 DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
         ----------------------   ------------  ---------------
        V  = 46.0-0.25E           R0 = 5.893    A0 = 0.62
        WS = 7.0                  RS = 6.393    AS = 0.35
        VSO= 7.0                  RSO= 5.893    ASO= 0.62
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 1(B)  NEUTRON OPTICAL POTENTIAL PARAMETERS

                 DEPTH (MEV)       RADIUS(FM)*   DIFFUSENESS(FM)
         ----------------------   ------------  ---------------
        V  = 49.29-0.5266E        R0 = 1.270    A0 = 0.664
        WS = 6.574+0.5038E        RS = 1.264    AS = 0.538
        VSO= 9.0                  RSO= 1.201    ASO= 0.367
                                   * COEFFICIENTS OF A**(1/3)
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2  LEVEL DENSITY PARAMETERS

 NUCLIDE       A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
 ---------------------------------------------------------------
 40-ZR- 94     1.275E+01 7.530E-01 4.411E-01 7.019E+00 2.320E+00
 40-ZR- 95     1.331E+01 6.070E-01 5.453E-01 3.985E+00 1.200E+00
 40-ZR- 96     1.320E+01 7.000E-01 2.235E-01 6.589E+00 2.490E+00
 40-ZR- 97     1.259E+01 5.590E-01 2.497E-01 3.084E+00 1.200E+00

 41-NB- 95     1.277E+01 7.500E-01 2.121E+00 5.782E+00 1.120E+00
 41-NB- 96     1.331E+01 5.880E-01 3.406E+00 2.530E+00 0.0
 41-NB- 97     1.337E+01 6.710E-01 9.771E-01 5.026E+00 1.290E+00
 41-NB- 98     1.380E+01 5.110E-01 2.350E+00 1.731E+00 0.0

 42-MO- 96     1.403E+01 7.410E-01 6.991E-01 7.645E+00 2.400E+00
 42-MO- 97     1.517E+01 6.800E-01 2.769E+00 6.036E+00 1.280E+00
 42-MO- 98     1.594E+01 6.900E-01 7.358E-01 7.888E+00 2.570E+00
 42-MO- 99     1.774E+01 6.200E-01 4.294E+00 6.058E+00 1.280E+00
 ---------------------------------------------------------------

 SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
 IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
 ASSUMED TO BE 5.291 FOR MO- 98 AND 2.875 FOR MO- 99.
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MAT number = 4246

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 42-MO- 99 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  NO RESOLVED RESONANCE PARAMETERS

  UNRESOLVED RESONANCE REGION : 24 EV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/2/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.  THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS
    OF MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.370E-4, S1 = 5.400E-4, S2 = 0.340E-4, SG = 26.5E-4,
    GG = 0.120 EV, R  = 6.699 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                   2200 M/S               RES. INTEG.
      TOTAL        13.70                     -
      ELASTIC       5.700                    -
      CAPTURE       8.000                   41.6

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 24 EV, THE CAPTURE AND ELASTIC SCATTERING CROSS SECTIONS
  WERE ASSUMED TO BE IN 1/V FORM AND CONSTANT, RESPECTIVELY.
  THE CAPTURE CROSS SECTION AT 0.0253 EV WAS DETERMINED BY THE
  SYSTEMATICS FROM THE NEIGHBORING MO ISOTOPES.  THE SCATTERING
  CROSS SECTION WAS ESTIMATED FROM R = 6.7 FM.  UNRESOLVED
  RESONANCE PARAMETERS WERE GIVEN IN THE ENERGY RANGE FROM 24 EV
  TO 100 KEV.

  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/3/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED BY IIJIMA AND KAWAI/4/ TO REPRODUCE A SYSTEMATIC
  TREND OF THE TOTAL CROSS SECTION.  THE OMP'S FOR CHARGED
  PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/5/
     ALPHA    = HUIZENGA AND IGO/6/
     DEUTERON = LOHR AND HAEBERLI/7/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/8/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/9/ WERE EVALUATED BY IIJIMA ET AL./10/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /11/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/12/ AND NUCLEAR DATA
    SHEETS/13/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             1/2 +
            1        0.0980          3/2 +
            2        0.2355          7/2 +
            3        0.3520          3/2 +
            4        0.5255          1/2 +
            5        0.5490          3/2 +
            6        0.6150          3/2 +
```

7	0.6870	9/2 -
8	0.7535	5/2 -
9	0.7930	3/2 +
10	0.8895	3/2 +
11	0.9050	1/2 +
12	0.9130	1/2 +
13	0.9450	3/2 +
14	0.9520	5/2 -
15	1.0330	1/2 -
16	1.1500	1/2 -

LEVELS ABOVE 1.199 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/14/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (2.48E-03) WAS DETERMINED FROM THE SYSTEMATICS OF RADIATION WIDTH (0.12 EV) AND THE AVERAGE S-WAVE RESONANCE LEVEL SPACING (48.3 EV) CALCULATED FROM THE LEVEL DENSITY PARAMETERS.

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT = 32 (N,N'D) CROSS SECTION
MT = 33 (N,N'T) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 78.9) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/15/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,P)	8.23 MB	(SYSTEMATICS OF FORREST/16/)
(N,ALPHA)	2.18 MB	(SYSTEMATICS OF FORREST)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 46.0-0.25E	R0 = 5.893	A0 = 0.62
WS = 7.0	RS = 6.393	AS = 0.35
VSO= 7.0	RSO= 5.893	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
40-ZR- 95		1.331E+01	6.070E-01	5.453E-01	3.985E+00	1.200E+00
40-ZR- 96		1.320E+01	7.000E-01	2.235E-01	6.589E+00	2.490E+00
40-ZR- 97		1.259E+01	5.590E-01	2.497E-01	3.084E+00	1.200E+00
40-ZR- 98	*	1.725E+01	6.633E-01	1.790E+00	7.555E+00	2.140E+00
41-NB- 96		1.331E+01	5.880E-01	3.406E+00	2.530E+00	0.0
41-NB- 97		1.337E+01	6.710E-01	9.771E-01	5.026E+00	1.290E+00
41-NB- 98		1.380E+01	5.110E-01	2.350E+00	1.731E+00	0.0
41-NB- 99	*	1.742E+01	6.566E-01	1.085E+01	6.300E+00	9.400E-01

42-MO- 97	1.517E+01	6.800E-01	2.769E+00	6.036E+00	1.280E+00
42-MO- 98	1.594E+01	6.900E-01	7.358E-01	7.888E+00	2.570E+00
42-MO- 99	1.774E+01	6.200E-01	4.294E+00	6.058E+00	1.280E+00
42-MO-100	1.780E+01	6.000E-01	6.702E-01	6.645E+00	2.220E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 2.875 FOR MO- 99 AND 5.125 FOR MO-100.

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MAT number = 4249

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 42-MO-100 JNDC       EVAL-AUG89 JNDC FP NUCLEAR DATA W.G.
                      DIST-MAY90 REV2-NOV93
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
89-08 MODIFICATION FOR JENDL-3 WAS MADE/2/.
90-10 MF=5: SPECTRA AT THRESHOLD ENERGIES WERE MODIFIED.
93-11 JENDL-3.2.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   *******************
      (2,151)       UNRESOLVED RESONANCE PARAMETERS
      (3,1)         CALCULATED FROM NEW OPTICAL POTENTIAL
      (3,4), (3,51-91), (3,16), (3,17), (3,22), (3,28)
                    TAKEN FROM JENDL FUSION FILE
      (3,32)        DELETED
      (4,16-91)     TAKEN FROM JENDL FUSION FILE
      (5,16-91)     TAKEN FROM JENDL FUSION FILE
     ***********************************************************

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      JENDL FUSION FILE /3/  (AS OF OCT. 1993)
        EVALUATED BY K.KOSAKO(NEDAC) AND S.CHIBA (NDC/JAERI)
        COMPILED BY K.KOSAKO

          THE INELASTIC SCATTERING, (N,2N), (N,3N), (N,NP), (N,NA)
        CROSS SECTIONS WERE CALCULATED WITH SINCROS-II SYSTEM /4/.
        THE OTHER CROSS SECTIONS WERE TAKEN FROM JENDL-3.1.  MF=6
        OF MT=16, 17, 22, 28 AND 91 WERE CREATED WITH F15TOB
        PROGRAM /3/ IN WHICH KUMABE'S SYSTEMATICS /5/ WAS USED.
        THE PRECOMPOUND/COMPOUND RATIO WAS CALCULATED BY THE
        SINCROS-II CODE SYSTEM/4/.
          OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED
        IN THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./4/.
        LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/6/.
     -------------------------------------------------------------


MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 26 KEV
    PARAMETERS WERE TAKEN FROM JENDL-2 WHICH WAS EVALUATED BY
    KIKUCHI ET AL./7/ ON THE BASIS OF THE FOLLOWING EXPERIMENTAL
    DATA:
       TRANSMISSION : WEIGMANN ET AL./8/
       CAPTURE      : WEIGMANN ET AL./9/, MUSGROVE ET AL./10/
    AVERAGE RADIATION WIDTHS OF 0.065 EV AND 0.08 EV WERE ADOPTED
    TO S-WAVE AND P-WAVE RESONANCES, RESPECTIVELY.  A NEGATIVE
    RESONANCE WAS ADDED AT -172 EV SO AS TO REPRODUCE THE THERMAL
    CAPTURE CROSS SECTION GIVEN BY MUGHABGHAB ET AL./11/
    SCATTERING RADIUS WAS TAKEN FROM REF./11/.

  UNRESOLVED RESONANCE REGION : 26 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/12/.  THE OBSERVED LEVEL
    SPACING WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 50 KEV:
    S0 = 0.370E-4, S1 = 5.479E-4, S2 = 0.365E-4, SG = 1.58E-4,
    GG = 0.085 EV, R  = 6.308 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           5.499                     -
      ELASTIC         5.300                     -
      CAPTURE         0.1990                     3.91

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/13/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1(A)
  WERE DETERMINED BY IIJIMA AND KAWAI/14/ TO REPRODUCE A SYSTEMA-
  TIC TREND OF THE TOTAL CROSS SECTION.  THIS SET WAS USED FOR
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CALCULATION OF THE CAPTURE CROSS SECTION WITH CASTHY AND THE PEGASUS CALCULATION, AND ANGULAR DISTRIBUTIONS OF ELASTICALLY SCATTERED NEUTRONS. ANOTHER SET OF PARAMETERS IN TABLE 1(B) WAS DETEMINED BY WATANABE/15/ TO FIT BETTER THE MEASUED TOTAL CROSS SECTION, AND WAS USED FOR THE TOTAL CROSS SECTION CALCULATION FOR JENDL-3.2. THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:

PROTON = PEREY/16/
ALPHA = HUIZENGA AND IGO/17/
DEUTERON = LOHR AND HAEBERLI/18/
HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/19/

PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT AND CAMERON/20/ WERE EVALUATED BY IIJIMA ET AL./21/ MORE EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE PRESENT WORK. TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED IN THE PRESENT CALCULATION. ENERGY DEPENDENCE OF SPIN CUT-OFF PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR /22/.

FOR JENDL-3.2, THE INELASTIC SCATTERING, (N,2N), (N,3N), (N,NP), (N,NA) CROSS SECTIONS WERE ADOPTED FROM JENDL FUSION FILE. THE CALCULATION WAS MADE WITH SINCROS-II SYSTEM/4/ BY ADOPTIG WALTER-GUSS OMP MODIFIED BY YAMAMURO/4/ FOR NEUTRONS, LEMOS OMP MODIFIED BY ARTHUR AND YOUNG/23/ FOR ALPHA, THE SAME OMP'S AS THE PEGASUS CALCULATION FOR OTHER CHARGED PARTICLES AND STANDARD LEVEL DENSITY PARAME- TERS OF SINCROS-II SYSTEM.

MT = 1 TOTAL
SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED. OPTICAL POTENTIAL PARAMETERS ARE GIVEN IN TABLE 1(B).

MT = 2 ELASTIC SCATTERING
CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

MT = 4, 51 - 91 INELASTIC SCATTERING
TAKEN FROM JENDL FUSION FILE. THE LEVEL SCHEME WAS TAKEN FROM REF./6/ CNTRIBUTIONS OF THE DIRECT PROCESS WAS CALCULATED FOR THE LEVELS MARKED WITH '*'.

NO.	ENERGY(MEV)	SPIN-PARITY	(DIRECT PROCESS)
GR.	0.0	0 +	
1	0.5356	2 +	*
2	0.6944	0 +	
3	1.0637	2 +	
4	1.1361	4 +	

LEVELS ABOVE 1.136 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
THESE CROSS SECTIONS WERE ADOPTED FROM JENDL FUSION FILE. THE (N,2N) CROSS SECTION CALCULATED WITH SINCROS-II WAS MULTIPLIED BY 1.08.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. OPTICAL POTENTIAL PARAMETERS ARE LISTED IN TABLE 1(A). DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/24/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (1.43E-04) WAS ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION MEASURED BY MUSGROVE ET AL./10/

MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (=50.6) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/25/ AND LEVEL DENSITY PARAMETERS.

FINALLY, (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,P) 2.50 MB (RECOMMENDED BY FORREST/26/)
(N,ALPHA) 2.80 MB (MEASURED BY IKEDA ET AL./27/)

MT = 251 MU-BAR

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    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT = 2
    CALCULATED WITH CASTHY/12/ AND OMP IN TABLE 1(A).
  MT = 51-54
    TAKEN FROM JENDL FUSION FILE DATA WHICH WAS CALCULATED WITH
    CASTHY AND DWUCK/28/ IN THE SINCROS-II SYSTEM.
  MT = 16,17,22,28,91
    TRANSFORMED FROM MF=6 DATA (DDX) OF JENDL FUSION FILE.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT = 16,17,22,28,91
    TRANSFORMED FROM MF=6 DATA (DDX) OF JENDL FUSION FILE.


=================================================================
<<FOLLOWING ARE PARAMETERS USED IN THE CASTHY AND PEGASUS CALC.>>
=================================================================

TABLE 1(A)  NEUTRON OPTICAL POTENTIAL PARAMETERS

                DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
         ----------------------   ------------  ---------------
        V  = 46.0-0.25E           R0 = 5.893    A0 = 0.62
        WS = 7.0                  RS = 6.393    AS = 0.35
        VSO= 7.0                  RSO= 5.893    ASO= 0.62
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 1(B)  NEUTRON OPTICAL POTENTIAL PARAMETERS

                DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
         ----------------------   ------------  ---------------
        V  = 49.29-0.5266E        R0 = 1.270    A0 = 0.664
        WS = 6.574+0.5038E        RS = 1.264    AS = 0.538
        VSO= 9.0                  RSO= 1.201    ASO= 0.367
                                   * COEFFICIENTS OF A**(1/3)
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2  LEVEL DENSITY PARAMETERS

 NUCLIDE  SYST A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)    PAIRING
 ---------------------------------------------------------------
 40-ZR- 96      1.320E+01 7.000E-01 2.235E-01 6.589E+00 2.490E+00
 40-ZR- 97      1.259E+01 5.590E-01 2.497E-01 3.084E+00 1.200E+00
 40-ZR- 98   *  1.725E+01 6.633E-01 1.790E+00 7.555E+00 2.140E+00
 40-ZR- 99   *  1.831E+01 6.566E-01 1.170E+01 6.957E+00 1.200E+00

 41-NB- 97      1.337E+01 6.710E-01 9.771E-01 5.026E+00 1.290E+00
 41-NB- 98      1.380E+01 5.110E-01 2.350E+00 1.731E+00 0.0
 41-NB- 99   *  1.742E+01 6.566E-01 1.085E+01 6.300E+00 9.400E-01
 41-NB-100   *  1.850E+01 6.500E-01 7.329E+01 5.699E+00 0.0

 42-MO- 98      1.594E+01 6.900E-01 7.358E-01 7.888E+00 2.570E+00
 42-MO- 99      1.774E+01 6.200E-01 4.294E+00 6.058E+00 1.280E+00
 42-MO-100      1.780E+01 6.000E-01 6.702E-01 6.645E+00 2.220E+00
 42-MO-101      2.085E+01 5.650E-01 7.153E+00 6.092E+00 1.280E+00
 ---------------------------------------------------------------
  SYST:  * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

 SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
 IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
 ASSUMED TO BE 5.125 FOR MO-100 AND 5.000 FOR MO-101.
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MAT number = 4331
 43-TC- 99 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-SEP90 REV2-NOV93
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.
93-11 JENDL-3.2 WAS MADE BY JNDC FPND W.G.

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)       RESOLVED RESONANCE PARAMETERS
     ***********************************************************


MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 4.219 KEV
    RESONANCE PARAMETERS WERE TAKEN FROM JENDL-2 WITH SLIGHT
    MODIFICATION.
       EVALUATION FOR JENDL-2 WAS MADE BY KIKUCHI /3/.
    PARAMETERS OF THE 1ST AND 2ND RESONANCES WERE ADOPTED FROM
    RECOMMENDED VALUES OF FISCHER ET AL./4/, AND SLIGHTLY
    ADJUSTED SO AS TO REPRODUCE THE CAPTURE CROSS SECTION OF
    20+-1 BARNS AT 0.0253 EV AND THE RESONANCE INTEGRAL OF
    340+-20 BARNS /5/.  PARAMETERS OF LEVELS BETWEEN 40 EV AND
    1.5 KEV WERE EVALUATED ON THE BASIS OF DATA MEASURED BY
    ADAMCHUK ET AL.  /6/ AND BY LITTLE AND BLOCK/7/.  IN THE
    ENERGY RANGE FROM 1.0 TO 2.6 KEV, ARTIFICIAL LEVELS WERE
    GENERATED WITH STAT /8/ BY ASSUMING D=0.04 EV, S0= 0.17E-4,
    S1=11.12E-4 AND THE AVERAGE RADIATION WIDTH OF 0.17 EV.  FOR
    THE RESONANCES OF WHICH ENERGY WAS ONLY MEASURED BY LITTLE
    AND BLOCK, THEIR PARAMETERS WERE ALSO ESTIMATED WITH STAT.
    ABOVE 2.66 KEV, EVALUATION WAS BASED ON THE CAPTURE AREAS
    MEASURED BY MACKLIN /9/.  SCATTERING RADIUS WAS TAKEN FROM
    THE COMPILATION OF MUGHABGHAB ET AL./5/
       FOR JENDL-3, TOTAL SPIN J OF SOME RESONANCES WAS TENTATIVE-
    LY ESTIMATED WITH A RANDOM NUMBER METHOD.  IN THIS PROCEDURE,
    NEUTRON WIDTHS FOR RESONANCES ABOVE 2.66 KEV WERE DETERMINED
    TO REPRODUCE THE CAPTURE AREAS MEASURED BY MACKLIN/9/.
       FOR JENDL-3.2, NEUTRON OR RADIATIVE CAPTURE WIDTHS FOR
    LEVELS BETWEEN 111 EV AND 754 EV WERE MODIFIED SO AS TO
    REPRODUCE THE CAPTURE AREA MEASURED BY LITTLE AND BLOCK/7/.

  UNRESOLVED RESONANCE REGION : 4.219 KEV - 100 KEV
    UNRESOLVED RESONANCE PARAMETERS WERE ADOPTED FROM JENDL-2.
    THE PARAMETERS WERE ADJUSTED TO REPRODUCE THE CAPTURE CROSS
    SECTION MEASURED BY MACKLIN /9/.  THE EFFECTIVE SCATTERING
    RADIUS WAS OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS
    SECTION AT 100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.414E-4, S1 = 4.241E-4, S2 = 0.488 E-4, SG = 90.4E-4,
    GG = 0.186 EV, R  = 6.215 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL          23.063                   -
      ELASTIC         3.422                   -
      CAPTURE        19.641                  312

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY/10/, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/11/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING RSO OF IIJIMA-KAWAI POTENTIAL/12/.  THE
  OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/13/
     ALPHA    = HUIZENGA AND IGO/14/
     DEUTERON = LOHR AND HAEBERLI/15/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/16/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/17/ WERE EVALUATED BY IIJIMA ET AL./18/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
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/19/.

MT = 1 TOTAL
SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

MT = 2 ELASTIC SCATTERING
CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

MT = 4, 51 - 91 INELASTIC SCATTERING
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS ADOPTED. THE LEVEL SCHEME WAS TAKEN FROM REF./20/

NO.	ENERGY(MEV)	SPIN-PARITY
GR.	0.0	9/2 +
1	0.1405	7/2 +
2	0.1426	1/2 -
3	0.1811	5/2 +
4	0.5091	3/2 -
5	0.5343	5/2 -
6	0.6254	7/2 +
7	0.6715	5/2 -
8	0.7263	11/2 +
9	0.7616	5/2 +
10	0.7620	13/2 +

LEVELS ABOVE 0.9 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/21/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (8.37E-03) WAS ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION OF 380 MILLI-BARNS AT 100 KEV MEASURED BY MACKLIN/22/.

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT = 32 (N,N'D) CROSS SECTION
MT = 33 (N,N'T) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =106 (N,HE3) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 101.5) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/23/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,2N), (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,2N)	1230.00	MB	(RECOMMENDED BY BYCHKOV ET AL./24/)
(N,P)	14.00	MB	(RECOMMENDED BY FORREST/25/)
(N,ALPHA)	7.00	MB	(RECOMMENDED BY FORREST)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 47.5	R0 = 5.972	A0 = 0.62
WS = 9.74	RS = 6.594	AS = 0.35
VSO= 7.0	RSO= 5.97	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
41-NB- 95	1.277E+01	7.500E-01	2.121E+00	5.782E+00	1.120E+00
41-NB- 96	1.331E+01	5.880E-01	3.406E+00	2.530E+00	0.0
41-NB- 97	1.337E+01	6.710E-01	9.771E-01	5.026E+00	1.290E+00
41-NB- 98	1.380E+01	5.110E-01	2.350E+00	1.731E+00	0.0
42-MO- 96	1.403E+01	7.410E-01	6.991E-01	7.645E+00	2.400E+00
42-MO- 97	1.517E+01	6.800E-01	2.769E+00	6.036E+00	1.280E+00
42-MO- 98	1.594E+01	6.900E-01	7.358E-01	7.888E+00	2.570E+00
42-MO- 99	1.774E+01	6.200E-01	4.294E+00	6.058E+00	1.280E+00
43-TC- 97	1.600E+01	6.700E-01	4.756E+00	6.089E+00	1.120E+00
43-TC- 98	1.659E+01	6.120E-01	1.776E+01	4.176E+00	0.0
43-TC- 99	1.600E+01	6.550E-01	2.973E+00	5.984E+00	1.290E+00
43-TC-100	1.637E+01	5.850E-01	1.189E+01	3.635E+00	0.0

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 7.899 FOR TC- 99 AND 5.0 FOR TC-100.

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MAT number = 4425

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 44-RU- 96 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  NO RESOLVED RESONANCE PARAMETERS

  UNRESOLVED RESONANCE REGION : 200 EV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/2/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV. THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS
    OF MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.440E-4, S1 = 4.300E-4, S2 = 0.630E-4, SG = 5.71E-4,
    GG = 0.150 EV, R  = 6.211 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S              RES. INTEG.
      TOTAL           5.390                   -
      ELASTIC         5.100                   -
      CAPTURE         0.2900                   7.30

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 200 EV, THE CAPTURE AND ELASTIC SCATTERING CROSS SECTIONS
  WERE ASSUMED TO BE IN 1/V FORM AND CONSTANT, RESPECTIVELY.  THE
  CAPTURE CROSS SECTION AT 0.0253 EV WAS TAKEN FROM REF./3/, AND
  THE ELASTIC SCATTERING CROSS SECTION WAS ESTIMATED BY ASSUMING
  R = 6.3 FM.  UNRESOLVED RESONANCE PARAMETERS WERE GIVEN IN THE
  ENERGY RANGE FROM 200 EV TO 100 KEV.

  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/4/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING RSO OF IIJIMA-KAWAI POTENTIAL/5/.  THE
  OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/6/
     ALPHA    = HUIZENGA AND IGO/7/
     DEUTERON = LOHR AND HAEBERLI/8/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/9/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/10/ WERE EVALUATED BY IIJIMA ET AL./11/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /12/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/13/ AND NUCLEAR DATA
    SHEETS/14/.

           NO.      ENERGY(MEV)    SPIN-PARITY    DWBA CAL.
           GR.       0.0             0  +
            1        0.8326          2  +            *
            2        1.5180          4  +
            3        1.9311          2  +
            4        2.1487          0  +
            5        2.1496          6  +
            6        2.2839          2  +
            7        2.4621          2  +
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          8        2.5247          2  +
          9        2.5290          2  +
         10        2.5762          2  +
         11        2.5882          5  -
         12        2.6513          2  +
         13        2.7399          1  +
      LEVELS ABOVE 2.76 MEV WERE ASSUMED TO BE OVERLAPPING.

    FOR THE LEVELS WITH AN ASTERISK, THE CONTRIBUTION OF DIRECT
    INELASTIC SCATTERING CROSS SECTIONS WAS CALCULATED BY THE
    DWUCK-4 CODE/15/.  DEFORMATION PARAMETER (BETA2 = 0.158) WAS
    BASED ON THE DATA COMPILED BY RAMAN ET AL./16/

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/17/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (5.43E-04) WAS ADJUSTED TO
    REPRODUCE THE CAPTURE CROSS SECTION OF 315 MILLI-BARNS AT 25
    KEV MEASURED BY SRIRAMACHANDRA ET AL./18/

  MT = 16  (N,2N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT = 32  (N,N'D) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =106  (N,HE3) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
  MT =111  (N,2P) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (= 118.0) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/19/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,P)          150.00  MB (RECOMMENDED BY FORREST/20/)
      (N,ALPHA)       31.90  MB (SYSTEMATICS OF FORREST/20/)
    THE (N,2N) CROSS SECTION WAS DETERMINED BY EYE-GUIDING OF
    THE DATA MEASURED BY BORMANN ET AL./21/

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY/2/.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  CONTRIBUTION OF DIRECT INELASTIC
  SCATTERING WAS CALCULATED WITH DWUCK-4.  FOR OTHER REACTIONS,
  ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
          ----------------------  ------------  ---------------
         V  = 47.5                RO = 5.972    AO = 0.62
         WS = 9.74                RS = 6.594    AS = 0.35
         VSO= 7.0                 RSO= 5.97     ASO= 0.62
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2  LEVEL DENSITY PARAMETERS

 NUCLIDE  SYST A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
 ---------------------------------------------------------------
 42-MO- 92      1.064E+01 7.770E-01 2.062E-01 5.938E+00 2.210E+00
 42-MO- 93      1.125E+01 7.800E-01 9.792E-01 5.457E+00 1.280E+00
 42-MO- 94      1.301E+01 6.850E-01 3.417E-01 5.770E+00 2.000E+00
 42-MO- 95      1.360E+01 7.150E-01 1.847E+00 5.835E+00 1.280E+00

 43-TC- 93   *  9.672E+00 6.989E-01 3.869E-01 3.036E+00 9.300E-01
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43-TC- 94	*	1.062E+01	6.915E-01	2.121E+00	2.589E+00	0.0
43-TC- 95	*	1.159E+01	6.842E-01	1.101E+00	3.745E+00	7.200E-01
43-TC- 96		1.741E+01	5.640E-01	1.503E+01	3.650E+00	0.0
44-RU- 94	*	9.776E+00	6.915E-01	6.034E-02	4.294E+00	2.210E+00
44-RU- 95		1.358E+01	6.720E-01	1.120E+00	5.133E+00	1.280E+00
44-RU- 96		1.343E+01	6.680E-01	3.373E-01	5.719E+00	2.000E+00
44-RU- 97		1.510E+01	6.390E-01	1.567E+00	5.300E+00	1.280E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 5.586 FOR RU- 96 AND 5.0 FOR RU- 97.

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MAT number = 4431

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 44-RU- 98 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  NO RESOLVED RESONANCE PARAMETERS

  UNRESOLVED RESONANCE REGION : 140 EV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/2/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV. THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS
    OF MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.440E-4, S1 = 4.300E-4, S2 = 0.610E-4, SG = 4.88E-4,
    GG = 0.130 EV, R  = 6.187 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL          13.10                     -
      ELASTIC         5.100                    -
      CAPTURE         8.000                   11.5

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 140 EV, THE CAPTURE AND ELASTIC SCATTERING CROSS SECTIONS
  WERE ASSUMED TO BE IN 1/V FORM AND CONSTANT, RESPECTIVELY.  THE
  CAPTURE CROSS SECTION AT 0.0253 EV WAS TAKEN FROM REF./3/, AND
  THE ELASTIC SCATTERING CROSS SECTION WAS ESTIMATED BY ASSUMING
  R = 6.3 FM.  UNRESOLVED RESONANCE PARAMETERS WERE GIVEN IN THE
  ENERGY RANGE FROM 140 EV TO 100 KEV.

  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/4/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING RSO OF IIJIMA-KAWAI POTENTIAL/5/.  THE
  OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/6/
     ALPHA    = HUIZENGA AND IGO/7/
     DEUTERON = LOHR AND HAEBERLI/8/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/9/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/10/ WERE EVALUATED BY IIJIMA ET AL./11/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /12/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/13/ AND NUCLEAR DATA
    SHEETS/14/.

           NO.      ENERGY(MEV)    SPIN-PARITY    DWBA CAL.
           GR.       0.0             0  +
            1        0.6524          2  +             *
            2        1.3211          0  +
            3        1.3978          4  +
            4        1.4146          2  +
            5        1.7972          3  +
            6        1.8169          1  +
            7        2.0133          3  +
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          8        2.2226          6  +
          9        2.2670          4  +
         10        2.2850          4  +
         11        2.4350          3  -
         12        2.5469          4  +
         13        2.6570          5  -
      LEVELS ABOVE 2.671 MEV WERE ASSUMED TO BE OVERLAPPING.

     FOR THE LEVELS WITH AN ASTERISK, THE CONTRIBUTION OF DIRECT
     INELASTIC SCATTERING CROSS SECTIONS WAS CALCULATED BY THE
     DWUCK-4 CODE/15/.  DEFORMATION PARAMETER (BETA2 = 0.1947) WAS
     BASED ON THE DATA COMPILED BY RAMAN ET AL./16/

   MT = 102  CAPTURE
     SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
     CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
     SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
     AND REFFO/17/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

     THE GAMMA-RAY STRENGTH FUNCTION (4.61E-04) WAS DETERMINED FROM
     THE SYSTEMATICS OF RADIATION WIDTH (0.13 EV) AND THE AVERAGE
     S-WAVE RESONANCE LEVEL SPACING (282 EV) CALCULATED FROM THE
     LEVEL DENSITY PARAMETERS.

   MT = 16  (N,2N) CROSS SECTION
   MT = 17  (N,3N) CROSS SECTION
   MT = 22  (N,N'A) CROSS SECTION
   MT = 28  (N,N'P) CROSS SECTION
   MT = 32  (N,N'D) CROSS SECTION
   MT =103  (N,P) CROSS SECTION
   MT =104  (N,D) CROSS SECTION
   MT =105  (N,T) CROSS SECTION
   MT =106  (N,HE3) CROSS SECTION
   MT =107  (N,ALPHA) CROSS SECTION
   MT =111  (N,2P) CROSS SECTION
     THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
     PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

     THE KALBACH'S CONSTANT K (=  96.1) WAS ESTIMATED BY THE
     FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/18/ AND LEVEL
     DENSITY PARAMETERS.

     FINALLY, THE (N,2N), (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
     NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
       (N,2N)      1050.00  MB (RECOMMENDED BY BYCHKOV+/19/)
       (N,P)         70.70  MB (SYSTEMATICS OF FORREST/20/)
       (N,ALPHA)     17.20  MB (SYSTEMATICS OF FORREST)

   MT = 251  MU-BAR
     CALCULATED WITH CASTHY.

 MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
   LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
   GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
   TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
   CALCULATED WITH CASTHY.  CONTRIBUTION OF DIRECT INELASTIC
   SCATTERING WAS CALCULATED WITH DWUCK-4.  FOR OTHER REACTIONS,
   ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

 MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
   ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
   PEGASUS FOR INELASTIC SCATTERING FROM OVERLAPPING LEVELS AND FOR
   OTHER NEUTRON EMITTING REACTIONS.

 TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                 DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
           ----------------------  ------------  ---------------
          V  = 47.5                R0 = 5.972    A0 = 0.62
          WS = 9.74                RS = 6.594    AS = 0.35
          VSO= 7.0                 RSO= 5.97     ASO= 0.62
   THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

 TABLE 2  LEVEL DENSITY PARAMETERS

  NUCLIDE  SYST A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
  ---------------------------------------------------------------
  42-MO- 94     1.301E+01 6.850E-01 3.417E-01 5.770E+00 2.000E+00
  42-MO- 95     1.360E+01 7.150E-01 1.847E+00 5.835E+00 1.280E+00
  42-MO- 96     1.403E+01 7.410E-01 6.991E-01 7.645E+00 2.400E+00
  42-MO- 97     1.517E+01 6.800E-01 2.769E+00 6.036E+00 1.280E+00
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43-TC- 95	*	1.159E+01	6.842E-01	1.101E+00	3.745E+00	7.200E-01
43-TC- 96		1.741E+01	5.640E-01	1.503E+01	3.650E+00	0.0
43-TC- 97		1.600E+01	6.700E-01	4.756E+00	6.089E+00	1.120E+00
43-TC- 98		1.659E+01	6.120E-01	1.776E+01	4.176E+00	0.0
44-RU- 96		1.343E+01	6.680E-01	3.373E-01	5.719E+00	2.000E+00
44-RU- 97		1.510E+01	6.390E-01	1.567E+00	5.300E+00	1.280E+00
44-RU- 98		1.382E+01	7.400E-01	6.070E-01	7.507E+00	2.400E+00
44-RU- 99		1.650E+01	6.570E-01	4.016E+00	6.235E+00	1.280E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 7.894 FOR RU- 98 AND 12.66 FOR RU- 99.

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MAT number = 4434

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 44-RU- 99 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-SEP90 REV2-OCT93
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/
93-10 JENDL-3.2 WAS MADE BY JNDC FPND W.G.

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)       RESOLVED RESONANCE PARAMETERS
     ***********************************************************


MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 1 KEV
    RESONANCE PARAMETERS WERE EVALUATED AS FOLLOWS:  RESONANCE
    ENERGIES, NEUTRON AND RADIATION WIDTHS WERE TAKEN FROM THE
    MEASUREMENT OF POPOV ET AL./2/  AS FOR LOWEST TWO LEVES, THE
    PARAMETERS WERE TAKEN FROM THE COMPILATION OF MUGHABGHAB ET
    AL./3/.  TOTAL SPIN J FOR RESONANCES MEASURED BY POPOV ET AL.
    WAS TENTATIVELY ESTIMATED WITH A RANDOM NUMBER METHOD.
    NEUTRON ORBITAL ANGULAR MOMENTUM L WAS ESTIMATED WITH A METHOD
    OF BOLLINGER AND THOMAS/4/.  AVERAGE RADIATION WIDTH OF 199
    MEV WAS DEDUCED AND ADOPTED TO THE LEVELS WHOSE RADIATION
    WIDTH WAS UNKNOWN.  SCATTERING RADIUS OF 6.1 FM WAS ASSUMED
    FROM THE SYSTEMATICS OF MEASURED VALUES FOR NEIGHBORING
    NUCLIDES.

    FOR JENDL-3.2, TOTAL SPIN J WAS DETERMINED BASED ON THE
    MEASUREMENTS OF COCEVA ET AL./5/ AND WITH A RANDUM NUMBER
    METHOD.

  UNRESOLVED RESONANCE REGION : 1 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/6/.  THE OBSERVED LEVEL
    SPACING WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION
    AT 100 KEV.  THE RADIATION WIDTH GG WAS BASED ON THE
    COMPILATION OF MUGHABGHAB ET AL./3/

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.440E-4, S1 = 4.200E-4, S2 = 0.600E-4, SG = 79.2E-4,
    GG = 0.195 EV, R  = 6.224 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S                RES. INTEG.
      TOTAL         10.985                       -
      ELASTIC        3.676                       -
      CAPTURE        7.309                     171

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/7/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING RSO OF IIJIMA-KAWAI POTENTIAL/8/.  THE
  OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/9/
     ALPHA    = HUIZENGA AND IGO/10/
     DEUTERON = LOHR AND HAEBERLI/11/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/12/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/13/ WERE EVALUATED BY IIJIMA ET AL./14/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /15/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).
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  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./16/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             5/2 +
            1        0.0894          3/2 +
            2        0.3221          5/2 +
            3        0.3404          7/2 +
            4        0.4420          3/2 +
            5        0.5755          5/2 +
            6        0.6180          7/2 +
            7        0.7192          9/2 +
            8        1.0480         11/2 +
            9        1.0700         11/2 -
           10        1.3130         11/2 +
           11        1.4960         13/2 +
           12        1.5720         15/2 -
      LEVELS ABOVE 1.7 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/17/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (7.80E-03) WAS DETERMINED FROM
    THE RADIATION WIDTH (0.195+-0.020 EV) AND AVERAGE S-WAVE
    RESONANCE LEVEL SPACING (25+-2 EV/3/).

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT = 32  (N,N'D) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =106  (N,HE3) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (= 126.7) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/18/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,P)          49.40  MB (SYSTEMATICS OF FORREST/19/)
      (N,ALPHA)      12.30  MB (SYSTEMATICS OF FORREST)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY/6/.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                 DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
          ----------------------   ------------  ---------------
        V  = 47.5                  R0 = 5.972    A0 = 0.62
        WS = 9.74                  RS = 6.594    AS = 0.35
        VSO= 7.0                   RSO= 5.97     ASO= 0.62
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2  LEVEL DENSITY PARAMETERS

 NUCLIDE       A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
 ---------------------------------------------------------------
 42-MO- 95     1.360E+01 7.150E-01 1.847E+00 5.835E+00 1.280E+00
 42-MO- 96     1.403E+01 7.410E-01 6.991E-01 7.645E+00 2.400E+00
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42-MO- 97	1.517E+01	6.800E-01	2.769E+00	6.036E+00	1.280E+00
42-MO- 98	1.594E+01	6.900E-01	7.358E-01	7.888E+00	2.570E+00
43-TC- 96	1.741E+01	5.640E-01	1.503E+01	3.650E+00	0.0
43-TC- 97	1.600E+01	6.700E-01	4.756E+00	6.089E+00	1.120E+00
43-TC- 98	1.659E+01	6.120E-01	1.776E+01	4.176E+00	0.0
43-TC- 99	1.600E+01	6.550E-01	2.973E+00	5.984E+00	1.290E+00
44-RU- 97	1.510E+01	6.390E-01	1.567E+00	5.300E+00	1.280E+00
44-RU- 98	1.382E+01	7.400E-01	6.070E-01	7.507E+00	2.400E+00
44-RU- 99	1.650E+01	6.570E-01	4.016E+00	6.235E+00	1.280E+00
44-RU-100	1.520E+01	7.200E-01	7.835E-01	8.078E+00	2.570E+00

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 12.66 FOR RU- 99 AND 4.062 FOR RU-100.

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MAT number = 4437

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 44-RU-100 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 11.89 KEV
    RESONANCE PARAMETERS WERE TAKEN FROM JENDL-2 EXCEPT FOR THOSE
    OF NEGATIVE AND HYPOTHETICAL RESONANCES, ANGULAR MOMENTUM FOR
    SOME LEVELS AND SCATTERING RADIUS.
       FOR JENDL-2, THE 228.5-EV RESONANCE WAS ADOPTED FROM
    PRIESMEYER AND JUNG/3/.  RESONANCES ABOVE 2679.7 EV WERE
    MAINLY BASED ON THE EXPERIMENTAL DATA OF MACKLIN AND HALPERIN
    /4/.  RESONANCES AT 120 EV AND BETWEEN 336 AND 2497 EV WERE
    HYPOTHETICAL LEVELS GENERATED BY ASSUMING S0=0.43E-4, D0=340
    EV, S1=4.1E-4, D1=110 EV. THE AVERAGE RADIATION WIDTH OF 0.124
    +-0.017 EV WAS DEDUCED AND ADOPTED TO THE LEVELS WHOSE
    RADIATION WIDTH WAS UNKNOWN.  TWO NEGATIVE RESONANCES WERE
    ADDED, AND PARAMETERS OF THE 120-EV LEVEL WERE ADJUSTED SO AS
    TO REPRODUCE THE CAPTURE CROSS SECTION OF 5.0+-0.6 BARNS AT
    0.0253 EV AND THE CAPTURE RESONANCE INTEGRAL OF 11.2+-1.1
    BARNS/5/.
       FOR JENDL-3, THE REDUCED NEUTRON WIDTH WAS DECREASED FROM
    43 MEV TO 23 MEV.  SCATTERING RADIUS WAS CHANGED TO 6.1 FM
    ACCORDING TO THE SYSTEMATICS OF MEASURED VALUES.  NUMBER OF
    NEGATIVE RESONANCES WAS REDUCED TO ONE AND ITS PARAMETERS WERE
    REEVALUATED.  NEUTRON ORBITAL ANGULAR MOMENTUM L OF SOME
    RESONANCES WAS ESTIMATED WITH A METHOD OF BOLLINGER AND THOMAS
    /6/.

  UNRESOLVED RESONANCE REGION : 11.89 KEV - 100 KEV
    UNRESOLVED RESONANCE PARAMETERS WERE ADOPTED FROM JENDL-2.
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/7/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.450E-4, S1 = 6.500E-4, S2 = 0.530E-4, SG = 3.91E-4,
    GG = 0.125 EV, R  = 4.971 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S                RES. INTEG.
      TOTAL         11.49                       -
      ELASTIC        6.465                      -
      CAPTURE        5.022                     11.2

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/8/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING RSO OF IIJIMA-KAWAI POTENTIAL/9/.  THE
  OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/10/
     ALPHA    = HUIZENGA AND IGO/11/
     DEUTERON = LOHR AND HAEBERLI/12/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/13/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/14/ WERE EVALUATED BY IIJIMA ET AL./15/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /16/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).
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MT = 4, 51 - 91  INELASTIC SCATTERING
  SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
  ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./17/.

         NO.      ENERGY(MEV)    SPIN-PARITY     DWBA CAL.
         GR.       0.0              0  +
          1        0.5396           2  +             *
          2        1.1304           0  +
          3        1.2265           4  +
          4        1.3621           2  +
          5        1.7407           0  +
          6        1.8653           1  +
          7        1.8812           3  +
          8        2.0517           0  +
          9        2.0639           3  -             *
         10        2.0777           6  +
         11        2.0993           2  -
         12        2.1673           2  -
         13        2.2406           1  +
         14        2.3872           0  +
         15        2.4694           2  -
         16        2.5168           2  +
    LEVELS ABOVE 2.613 MEV WERE ASSUMED TO BE OVERLAPPING.

  FOR THE LEVELS WITH AN ASTERISK, THE CONTRIBUTION OF DIRECT
  INELASTIC SCATTERING CROSS SECTIONS WAS CALCULATED BY THE
  DWUCK-4 CODE/18/.  DEFORMATION PARAMETERS (BETA2 = 0.2172 AND
  BETA3 = 0.116) WERE BASED ON THE DATA COMPILED BY RAMAN ET
  AL./19/ AND SPEAR/20/, RESPECTIVELY.

MT = 102  CAPTURE
  SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
  CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
  SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
  AND REFFO/21/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

  THE GAMMA-RAY STRENGTH FUNCTION (3.79E-04) WAS ADJUSTED TO
  REPRODUCE THE CAPTURE CROSS SECTION OF 120 MILLI-BARNS AT 70
  KEV MEASURED BY MACKLIN ET AL./22,23/

MT = 16  (N,2N) CROSS SECTION
MT = 17  (N,3N) CROSS SECTION
MT = 22  (N,N'A) CROSS SECTION
MT = 28  (N,N'P) CROSS SECTION
MT = 32  (N,N'D) CROSS SECTION
MT =103  (N,P) CROSS SECTION
MT =104  (N,D) CROSS SECTION
MT =105  (N,T) CROSS SECTION
MT =107  (N,ALPHA) CROSS SECTION
  THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
  PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

  THE KALBACH'S CONSTANT K (=  89.2) WAS ESTIMATED BY THE
  FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/24/ AND LEVEL
  DENSITY PARAMETERS.

  FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
  NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
    (N,P)          15.00  MB (RECOMMENDED BY FORREST/25/)
    (N,ALPHA)       8.70  MB (SYSTEMATICS OF FORREST/25/)

MT = 251  MU-BAR
  CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  CONTRIBUTION OF DIRECT INELASTIC
  SCATTERING WAS CALCULATED WITH DWUCK-4.  FOR OTHER REACTIONS,
  ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
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V = 47.5 RO = 5.972 AO = 0.62
WS = 9.74 RS = 6.594 AS = 0.35
VSO= 7.0 RSO= 5.97 ASO= 0.62
THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
42-MO- 96	1.403E+01	7.410E-01	6.991E-01	7.645E+00	2.400E+00
42-MO- 97	1.517E+01	6.800E-01	2.769E+00	6.036E+00	1.280E+00
42-MO- 98	1.594E+01	6.900E-01	7.358E-01	7.888E+00	2.570E+00
42-MO- 99	1.774E+01	6.200E-01	4.294E+00	6.058E+00	1.280E+00
43-TC- 97	1.600E+01	6.700E-01	4.756E+00	6.089E+00	1.120E+00
43-TC- 98	1.659E+01	6.120E-01	1.776E+01	4.176E+00	0.0
43-TC- 99	1.600E+01	6.550E-01	2.973E+00	5.984E+00	1.290E+00
43-TC-100	1.637E+01	5.850E-01	1.189E+01	3.635E+00	0.0
44-RU- 98	1.382E+01	7.400E-01	6.070E-01	7.507E+00	2.400E+00
44-RU- 99	1.650E+01	6.570E-01	4.016E+00	6.235E+00	1.280E+00
44-RU-100	1.520E+01	7.200E-01	7.835E-01	8.078E+00	2.570E+00
44-RU-101	1.726E+01	6.700E-01	7.228E+00	6.836E+00	1.280E+00

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 4.062 FOR RU-100 AND 14.30 FOR RU-101.

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MAT number = 4440

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 44-RU-101 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-SEP90 REV2-OCT93
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.
93-10 JENDL-3.2 WAS MADE BY JNDC FPND W.G.

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)        SMALL CHANGE IN UNRESOLVED RES. PARAMTERS
      (3,2), (3,4), (3,51-91), (3,102)
      (4,51-91)
                     LEVEL SCHEME FOR INELASTIC SCATTERING CROSS
                     SECTIONS WERE REPLACED.
     ***********************************************************


MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 1.06 KEV
    RESONANCE PARAMETERS OF JENDL-2 WERE MODIFIED ACCORDING TO NEW
    EXPERIMENTAL DATA.
       FOR JENDL-2, PARAMETERS WERE DETERMINED FROM THE EXPERIMEN-
    TAL DATA OF PRIESMEYER AND JUNG/3/ AND POPOV ET AL./4/
    VALUES OF SPIN J WERE BASED ON THE DATA OF COCEVA ET AL./5/
    A NEGATIVE RESONANCE WAS ADDED AT -20 EV TO REPRODUCE THE
    CAPTURE CROSS SECTION OF 3.4+-0.9 BARNS AT 0.0253 EV/6/.
    AVERAGE RADIATION WIDTH  OF 0.180+-0.022 EV WAS DEDUCED, AND
    ADOPTED TO THE LEVELS WHOSE RADIATION WIDTH WAS UNKNOWN.
       FOR JENDL-3, PARAMETERS OF 40 LEVELS WERE REEVALUATED ON
    THE BASIS OF THE NEW EXPERIMENTAL DATA OF ANUFRIEV/7/ FOR
    NEUTRON WIDTHS.  RADIATION WIDTHS AND TOTAL SPIN J OF
    SEVERAL LEVELS WERE ALSO REVISED ACCORDING TO ANUFRIEV'S
    DATA.  SCATTERING RADIUS WAS MODIFIED TO 6.1 FM.  TOTAL SPIN
    J OF SOME RESONANCES WAS TENTATIVELY ESTIMATED WITH A RANDOM
    NUMBER METHOD.  NEUTRON ORBITAL ANGULAR MOMENTUM L OF SOME
    RESONANCES WAS DETERMINED WITH A METHOD OF BOLLINGER AND
    THOMAS/8/.

  UNRESOLVED RESONANCE REGION : 1.06 KEV - 100 KEV
    THE PARAMETERS WERE ADJUSTED TO REPRODUCE THE CAPTURE CROSS
    SECTION MEASURED BY MACKLIN ET AL./9,10/  THE EFFECTIVE
    SCATTERING RADIUS WAS OBTAINED FROM FITTING TO THE CALCULATED
    TOTAL CROSS SECTION AT 100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.59E-4, S1 = 6.10E-4, S2 = 0.54E-4, SG = 105.E-4,
    GG = 0.173 EV, R  = 5.062 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           7.100                   -
      ELASTIC         3.741                   -
      CAPTURE         3.359                 100

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY/11/, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/12/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING RSO OF IIJIMA-KAWAI POTENTIAL/13/.  THE
  OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/14/
     ALPHA    = HUIZENGA AND IGO/15/
     DEUTERON = LOHR AND HAEBERLI/16/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/17/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/18/ WERE EVALUATED BY IIJIMA ET AL./19/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /20/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.
```

MT = 2 ELASTIC SCATTERING
CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

MT = 4, 51 - 91 INELASTIC SCATTERING
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS ADOPTED. THE LEVEL SCHEME WAS TAKEN FROM REF./21/.

NO.	ENERGY(MEV)	SPIN-PARITY
GS	0.0	5/2 +
1	0.12723	3/2 +
2	0.30685	7/2 +
3	0.31133	5/2 +
4	0.32480	1/2 +
5	0.42230	3/2 +
6	0.52750	11/2 -
7	0.53500	5/2 +
8	0.54508	7/2 +
9	0.59830	5/2 -
10	0.61630	3/2 +
11	0.62300	3/2 +
12	0.62350	1/2 +
13	0.68400	3/2 +
14	0.71800	1/2 -
15	0.72000	9/2 +
16	0.82300	3/2 +
17	0.84278	7/2 +
18	0.90800	1/2 -
19	0.92700	3/2 +
20	0.92872	9/2 +
21	0.93847	7/2 +
22	0.97340	5/2 +
23	1.0012	11/2 +
24	1.0410	3/2 +
25	1.0510	7/2 +
26	1.0980	1/2 +
27	1.1100	1/2 +
28	1.1690	3/2 +

LEVELS ABOVE 1.2068 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/22/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (1.16E-02) WAS ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION OF 500 MILLI-BARNS AT 100 KEV MEASURED BY MACKLIN ET AL./9,10/

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT = 32 (N,N'D) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =106 (N,HE3) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 106.5) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/23/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,P)	24.00 MB	(SYSTEMATICS OF FORREST/24/)
(N,ALPHA)	6.07 MB	(SYSTEMATICS OF FORREST)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

	DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
	V = 47.5	R0 = 5.972	A0 = 0.62
	WS = 9.74	RS = 6.594	AS = 0.35
	VSO= 7.0	RSO= 5.97	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
42-MO- 97	1.517E+01	6.800E-01	2.769E+00	6.036E+00	1.280E+00
42-MO- 98	1.594E+01	6.900E-01	7.358E-01	7.888E+00	2.570E+00
42-MO- 99	1.774E+01	6.200E-01	4.294E+00	6.058E+00	1.280E+00
42-MO-100	1.780E+01	6.000E-01	6.702E-01	6.645E+00	2.220E+00
43-TC- 98	1.659E+01	6.120E-01	1.776E+01	4.176E+00	0.0
43-TC- 99	1.600E+01	6.550E-01	2.973E+00	5.984E+00	1.290E+00
43-TC-100	1.637E+01	5.850E-01	1.189E+01	3.635E+00	0.0
43-TC-101	1.675E+01	6.440E-01	6.361E+00	5.761E+00	9.400E-01
44-RU- 99	1.650E+01	6.570E-01	4.016E+00	6.235E+00	1.280E+00
44-RU-100	1.520E+01	7.200E-01	7.835E-01	8.078E+00	2.570E+00
44-RU-101	1.726E+01	6.700E-01	7.228E+00	6.836E+00	1.280E+00
44-RU-102	1.643E+01	6.550E-01	8.872E-01	7.106E+00	2.220E+00

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 14.30 FOR RU-101 AND 7.654 FOR RU-102.

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MAT number = 4443

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 44-RU-102 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 13.4 KEV
    RESONANCE PARAMETERS OF JENDL-2/1/ WERE MODIFIED ACCORDING
    TO NEW EXPERIMENTAL DATA.
      FOR JENDL-2, RESONANCE ENERGIES BELOW 2.5 KEV WERE TAKEN
    FROM THE DATA OF PRIESMEYER AND JUNG/3/ AND SHAW ET AL./4/,
    AND THE OTHER RESONANCES ABOVE 2.7 KEV FROM MACKLIN AND
    HALPERIN/5/.  THE NEUTRON AND RADIATION WIDTHS OF LARGE
    RESONANCES WERE TAKEN FROM PRIESMEYER AND JUNG/3/ AND MACKLIN
    AND HALPERIN/5/.  FOR OTHERS, THE AVERAGE RADIATION WIDTH OF
    0.112+-0.027 EV WAS ADOPTED.  FOR LEVELS OBSERVED BY SHAW ET
    AL. AND FOR THREE FICTITIOUS LEVELS AT 2.467, 2.556 AND 2.645
    KEV, THE PARAMETERS WERE DETERMINED BY ASSUMING S0=0.43E-4,
    D0=340 EV, S1=4.1E-4 AND D1=110 EV.  PARAMETERS OF THE
    NEGATIVE LEVEL ADDED AT -146 EV AND THE FIRST POSITIVE LEVEL
    WERE ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION OF 1.21
    +-0.07 BARNS AT 0.0253 EV AND ITS RESONANCE INTEGRAL OF 4.2
    +-0.1 BARNS/6/.
      FOR JENDL-3, NEUTRON AND RADIATION WIDTHS OF 14 RESONANCES
    WERE REEVALUATED ON THE BASIS OF THE EXPERIMENTAL DATA OF
    ANUFRIEV ET AL./7/  FOR THE RESONANCES OBSERVED BY SHAW ET
    AL., REDUCED NEUTRON WIDTHS WERE GIVEN AS 6.5 MEV AND 65 MEV
    FOR S-WAVE AND P-WAVE RESONANCES, RESPECTIVELY.  PARAMETERS OF
    THE NEGATIVE RESONANCE WERE ALSO REVISE.  SCATTERING RADIUS
    WAS MODIFIED FROM 6.35 FM TO 6.1 FM BASED ON THE SYSTEMATICS.
    NEUTRON ORBITAL ANGULAR MOMENTUM L OF SOME RESONANCES WAS
    ESTIMATED WITH A METHOD OF BOLLINGER AND THOMAS/8/.

  UNRESOLVED RESONANCE REGION : 13.4 KEV - 100 KEV
    UNRESOLVED RESONANCE PARAMETERS WERE ADOPTED FROM JENDL-2.
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/9/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.450E-4, S1 = 5.000E-4, S2 = 0.530E-4, SG = 3.61E-4,
    GG = 0.115 EV, R  = 5.756 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                    2200 M/S               RES. INTEG.
      TOTAL         6.791                    -
      ELASTIC       5.561                    -
      CAPTURE       1.229                   4.32

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/10/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING RSO OF IIJIMA-KAWAI POTENTIAL/11/.  THE
  OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/12/
     ALPHA    = HUIZENGA AND IGO/13/
     DEUTERON = LOHR AND HAEBERLI/14/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/15/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/16/ WERE EVALUATED BY IIJIMA ET AL./17/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /18/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.
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MT = 2 ELASTIC SCATTERING
CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

MT = 4, 51 - 91 INELASTIC SCATTERING
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS ADOPTED. THE LEVEL SCHEME WAS TAKEN FROM REF./19/.

NO.	ENERGY(MEV)	SPIN-PARITY	DWBA CAL.
GR.	0.0	0 +	
1	0.4751	2 +	*
2	0.9437	0 +	
3	1.1032	2 +	
4	1.1064	4 +	
5	1.5217	3 +	
6	1.5806	2 +	
7	1.6027	4 +	
8	1.7987	4 +	
9	1.8371	0 +	
10	1.8732	6 +	
11	2.0369	2 +	
12	2.0442	3 -	*
13	2.2192	5 +	
14	2.2612	2 +	
15	2.3720	5 -	
16	2.4211	4 +	
17	2.4419	4 +	

LEVELS ABOVE 2.5 MEV WERE ASSUMED TO BE OVERLAPPING.

FOR THE LEVELS WITH AN ASTERISK, THE CONTRIBUTION OF DIRECT INELASTIC SCATTERING CROSS SECTIONS WAS CALCULATED BY THE DWUCK-4 CODE/20/. DEFORMATION PARAMETERS (BETA2 = 0.2443 AND BETA3 = 0.196) WERE BASED ON THE DATA COMPILED BY RAMAN ET AL./21/ AND SPEAR/22/, RESPECTIVELY.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/23/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (3.44E-04) WAS ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION OF 110 MILLI-BARNS AT 70 KEV MEASURED BY MACKLIN ET AL./24,25/

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 72.0) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/26/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,P)	16.70 MB	(SYSTEMATICS OF FORREST/27/)
(N,ALPHA)	6.20 MB	(RECOMMENDED BY FORREST/27/)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. CONTRIBUTION OF DIRECT INELASTIC SCATTERING WAS CALCULATED WITH DWUCK-4. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING FROM OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

	DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
	V = 47.5	R0 = 5.972	A0 = 0.62
	WS = 9.74	RS = 6.594	AS = 0.35
	VSO= 7.0	RSO= 5.97	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
42-MO- 98	1.594E+01	6.900E-01	7.358E-01	7.888E+00	2.570E+00
42-MO- 99	1.774E+01	6.200E-01	4.294E+00	6.058E+00	1.280E+00
42-MO-100	1.780E+01	6.000E-01	6.702E-01	6.645E+00	2.220E+00
42-MO-101	2.085E+01	5.650E-01	7.153E+00	6.092E+00	1.280E+00
43-TC- 99	1.600E+01	6.550E-01	2.973E+00	5.984E+00	1.290E+00
43-TC-100	1.637E+01	5.850E-01	1.189E+01	3.635E+00	0.0
43-TC-101	1.675E+01	6.440E-01	6.361E+00	5.761E+00	9.400E-01
43-TC-102	1.761E+01	5.400E-01	1.217E+01	3.317E+00	0.0
44-RU-100	1.520E+01	7.200E-01	7.835E-01	8.078E+00	2.570E+00
44-RU-101	1.726E+01	6.700E-01	7.228E+00	6.836E+00	1.280E+00
44-RU-102	1.643E+01	6.550E-01	8.872E-01	7.106E+00	2.220E+00
44-RU-103	1.890E+01	6.480E-01	1.210E+01	7.110E+00	1.280E+00

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 7.654 FOR RU-102 AND 5.045 FOR RU-103.

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MAT number = 4446

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 44-RU-103 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  NO RESOLVED RESONANCE PARAMETERS

  UNRESOLVED RESONANCE REGION : 11.05 EV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/3/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.450E-4, S1 = 6.000E-4, S2 = 0.530E-4, SG = 76.7E-4,
    GG = 0.170 EV, R  = 5.590 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                   2200 M/S               RES. INTEG.
      TOTAL       13.10                     -
      ELASTIC      5.100                    -
      CAPTURE      8.000                   91.3

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 11.05 EV, THE CAPTURE AND ELASTIC SCATTERING CROSS
  SECTIONS WERE ASSUMED TO BE IN 1/V FORM AND CONSTANT,
  RESPECTIVELY. THERMAL CAPTURE CROSS SECTION WAS DETERMINED BY
  THE SYSTEMATICS FROM THE NEIGHBORING RU ISOTOPES.  THE
  SCATTERING CROSS SECTION WAS CALCULATED FROM R = 6.3 FM.
  UNRESOLVED RESONANCE PARAMETERS WERE GIVEN IN THE ENERGY RANGE
  FROM 11.05 EV TO 100 KEV.

  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/4/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING RSO OF IIJIMA-KAWAI POTENTIAL/5/.  THE OMP'S
  FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/6/
     ALPHA    = HUIZENGA AND IGO/7/
     DEUTERON = LOHR AND HAEBERLI/8/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/9/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/10/ WERE EVALUATED BY IIJIMA ET AL./11/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /12/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./13/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0            3/2 +
            1        0.0027         5/2 +
            2        0.1360         5/2 +
            3        0.1742         1/2 +
            4        0.2134         7/2 +
            5        0.2380        11/2 -
            6        0.2877         1/2 +
            7        0.2974         7/2 -
            8        0.3465         5/2 +
            9        0.4056         3/2 +
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         10         0.4319          1/2 +
         11         0.4990          5/2 +
     LEVELS ABOVE 0.511 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/14/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (7.69E-03) WAS DETERMINED FROM
    THE SYSTEMATICS OF RADIATION WIDTH (0.170 EV) AND AVERAGE
    S-WAVE RESONANCE LEVEL SPACING (22.1 EV).

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT = 32  (N,N'D) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (= 111.5) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/15/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,P)          11.60  MB (SYSTEMATICS OF FORREST/16/)
      (N,ALPHA)       2.86  MB (SYSTEMATICS OF FORREST)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING FROM OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
         ----------------------   ------------  ---------------
        V  = 47.5                 R0 = 5.972    A0 = 0.62
        WS = 9.74                 RS = 6.594    AS = 0.35
        VSO= 7.0                  RSO= 5.97     ASO= 0.62
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2  LEVEL DENSITY PARAMETERS

 NUCLIDE   SYST A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
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 42-MO- 99      1.774E+01 6.200E-01 4.294E+00 6.058E+00 1.280E+00
 42-MO-100      1.780E+01 6.000E-01 6.702E-01 6.645E+00 2.220E+00
 42-MO-101      2.085E+01 5.650E-01 7.153E+00 6.092E+00 1.280E+00
 42-MO-102   *  1.856E+01 6.452E-01 1.419E+00 8.145E+00 2.520E+00

 43-TC-100      1.637E+01 5.850E-01 1.189E+01 3.635E+00 0.0
 43-TC-101      1.675E+01 6.440E-01 6.361E+00 5.761E+00 9.400E-01
 43-TC-102      1.761E+01 5.400E-01 1.217E+01 3.317E+00 0.0
 43-TC-103      1.810E+01 6.310E-01 6.436E+00 6.379E+00 1.240E+00

 44-RU-101      1.726E+01 6.700E-01 7.228E+00 6.836E+00 1.280E+00
 44-RU-102      1.643E+01 6.550E-01 8.872E-01 7.106E+00 2.220E+00
 44-RU-103      1.890E+01 6.480E-01 1.210E+01 7.110E+00 1.280E+00
 44-RU-104      1.650E+01 6.780E-01 8.593E-01 7.878E+00 2.520E+00
 ---------------------------------------------------------------
  SYST:  * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

 SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
 IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
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ASSUMED TO BE 5.045 FOR RU-103 AND 4.524 FOR RU-104.

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MAT number = 4449
 44-RU-104 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 11.12 KEV
    RESONANCE PARAMETERS WERE TAKEN FROM JENDL-2 EXCEPT THOSE OF
    THE 1ST POSITIVE AND NEGATIVE RESONANCES.
       PARAMETERS FOR JENDL-2 WERE EVALUATED AS FOLLOWS:
    RESONANCE ENERGIES BELOW 2 KEV WERE TAKEN FROM THE EXPERIMEN-
    TAL DATA BY PRIESMEYER AND JUNG/3/ AND SHAW ET AL./4/, OTHER
    RESONANCES ABOVE 2.7 KEV WERE DETERMINED FROM MACKLIN AND
    HALPERIN/5/.  THE NEUTRON WIDTHS WERE EVALUATED ON THE BASIS
    OF THE DATA OF PRIESMEYER AND JUNG, AND OF MACKLIN AND
    HALPERIN.  THE RADIATION WIDTHS OF LARGE RESONANCES WERE TAKEN
    FROM REF./5/  FOR THE OTHERS, THE AVERAGE RADIATION WIDTH OF
    0.103+-0.018 EV WAS DEDUCED, AND ADOPTED TO THE LEVELS WHOSE
    RADIATION WIDTH WAS UNKNOWN.  SEVEN HYPOTHETICAL RESONANCES
    WERE GENERATED IN THE ENERGY RANGE FROM 2 TO 2.7 KEV.  FOR THE
    LEVELS OBSERVED BY SHAW ET AL. AND THE HYPOTHETICAL ONES,
    REDUCED NEUTRON WIDTHS OF 12 AND 38 MEV WERE GIVEN FOR S-WAVE
    AND P-WAVE RESONANCES, RESPECTIVELY.  A NEGATIVE RESONANCE WAS
    ADDED AT -941 EV SO AS TO REPRODUCE THE CAPTURE CROSS SECTION
    OF 0.32+-0.02 BARNS AT 0.0253 EV/6/.
       FOR JENDL-3, PARAMETERS OF THE FIRST POSITIVE AND NEGATIVE
    RESONANCES WERE MODIFIED SO AS TO REPRODUCE THE RESONANCE
    INTEGRAL RECOMMENDED BY MUGHABGHAB ET AL./6/  SCATTERING
    RADIUS WAS REDUCED FROM 6.35 FM TO 6.1 FM ON THE BASIS OF THE
    SYSTEMATICS.

  UNRESOLVED RESONANCE REGION : 11.12 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0 AND S2 WERE CALCULATED WITH
    OPTICAL MODEL CODE CASTHY/7/, AND S1 WAS BASED ON THE THE
    COMPILATION OF MUGHABGHAB ET AL./6/  THE OBSERVED LEVEL
    SPACING WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.450E-4, S1 = 5.700E-4, S2 = 0.530E-4, SG = 2.95E-4,
    GG = 0.110 EV, R  = 5.366 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           5.558                    -
      ELASTIC         5.236                    -
      CAPTURE         0.3226                    6.57

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/8/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING RSO OF IIJIMA-KAWAI POTENTIAL/9/.  THE
  OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/10/
     ALPHA    = HUIZENGA AND IGO/11/
     DEUTERON = LOHR AND HAEBERLI/12/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/13/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/14/ WERE EVALUATED BY IIJIMA ET AL./15/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /16/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
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    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./17/.

           NO.      ENERGY(MEV)    SPIN-PARITY    DWBA CAL.
           GR.       0.0             0  +
            1        0.3580          2  +            *
            2        0.8885          4  +
            3        0.8930          2  +
            4        0.9881          0  +
            5        1.2423          3  +
      LEVELS ABOVE 1.5 MEV WERE ASSUMED TO BE OVERLAPPING.

    FOR THE LEVELS WITH AN ASTERISK, THE CONTRIBUTION OF DIRECT
    INELASTIC SCATTERING CROSS SECTIONS WAS CALCULATED BY THE
    DWUCK-4 CODE/18/.  DEFORMATION PARAMETER (BETA2 = 0.2742) WAS
    BASED ON THE DATA COMPILED BY RAMAN ET AL./19/

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/20/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (2.85E-04) WAS ADJUSTED TO
    REPRODUCE THE CAPTURE CROSS SECTION OF 95 MILLI-BARNS AT 70
    KEV MEASURED BY MACKLIN ET AL./21,22/

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (=  62.0) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/23/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,P)            7.00  MB (RECOMMENDED BY FORREST/24/)
      (N,ALPHA)        2.60  MB (RECOMMENDED BY FORREST)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  CONTRIBUTION OF DIRECT INELASTIC
  SCATTERING WAS CALCULATED WITH DWUCK-4.  FOR OTHER REACTIONS,
  ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING FROM OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                 DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
          ----------------------   ------------  ---------------
           V  = 47.5               R0 = 5.972    A0 = 0.62
           WS = 9.74               RS = 6.594    AS = 0.35
           VSO= 7.0                RSO= 5.97     ASO= 0.62
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2  LEVEL DENSITY PARAMETERS

 NUCLIDE   SYST A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
 ---------------------------------------------------------------
 42-MO-100      1.780E+01 6.000E-01 6.702E-01 6.645E+00 2.220E+00
 42-MO-101      2.085E+01 5.650E-01 7.153E+00 6.092E+00 1.280E+00
 42-MO-102  *   1.856E+01 6.452E-01 1.419E+00 8.145E+00 2.520E+00
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42-MO-103	2.175E+01	5.300E-01	5.321E+00	5.655E+00	1.280E+00
43-TC-101	1.675E+01	6.440E-01	6.361E+00	5.761E+00	9.400E-01
43-TC-102	1.761E+01	5.400E-01	1.217E+01	3.317E+00	0.0
43-TC-103	1.810E+01	6.310E-01	6.436E+00	6.379E+00	1.240E+00
43-TC-104	1.600E+01	5.500E-01	7.030E+00	2.960E+00	0.0
44-RU-102	1.643E+01	6.550E-01	8.872E-01	7.106E+00	2.220E+00
44-RU-103	1.890E+01	6.480E-01	1.210E+01	7.110E+00	1.280E+00
44-RU-104	1.650E+01	6.780E-01	8.593E-01	7.878E+00	2.520E+00
44-RU-105	2.025E+01	6.060E-01	1.144E+01	6.747E+00	1.280E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 4.524 FOR RU-104 AND 5.0 FOR RU-105.

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MAT number = 4455

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 44-RU-106 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  NO RESOLVED RESONANCE PARAMETERS

  UNRESOLVED RESONANCE REGION : 500 EV - 100 KEV
    UNRESOLVED RESONANCE PARAMETERS WERE ADOPTED FROM JENDL-2.
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/3/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.450E-4, S1 = 6.000E-4, S2 = 0.530E-4, SG = 1.59E-4,
    GG = 0.150 EV, R  = 5.157 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                      2200 M/S               RES. INTEG.
      TOTAL            3.488                   -
      ELASTIC          3.342                   -
      CAPTURE          0.1460                   2.01

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 500 EV, THE CAPTURE AND ELASTIC SCATTERING CROSS SECTIONS
  WERE ASSUMED TO BE IN 1/V FORM AND CONSTANT, RESPECTIVELY.  THE
  THERMAL CAPTURE CROSS SECTION WAS ADOPTED FROM REF./4/.  THE
  SCATTERING CROSS SECTION WAS CALCULATED FROM R = 5.1566 FM.
  UNRESOLVED RESONANCE PARAMETERS WERE GIVEN IN THE ENERGY RANGE
  FROM 500 EV TO 100 KEV.

  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/5/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING RSO OF IIJIMA-KAWAI POTENTIAL/6/.  THE
  OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/7/
     ALPHA    = HUIZENGA AND IGO/8/
     DEUTERON = LOHR AND HAEBERLI/9/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/10/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/11/ WERE EVALUATED BY IIJIMA ET AL./12/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /13/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./14/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             0  +
            1        0.2703          2  +
            2        0.7140          4  +
            3        0.7927          2  +
            4        0.9910          0  +
      LEVELS ABOVE 1.092 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
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SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/15/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (1.50E-04) WAS DETERMINED FROM THE SYSTEMATICS OF RADIATION WIDTH (0.15 EV) AND AVERAGE S-WAVE RESONANCE LEVEL SPACING (1.0 KEV).

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION

THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 65.2) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/16/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,P)	3.87 MB	(SYSTEMATICS OF FORREST/17/)
(N,ALPHA)	0.86 MB	(SYSTEMATICS OF FORREST)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING FROM OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 47.5	R0 = 5.972	A0 = 0.62
WS = 9.74	RS = 6.594	AS = 0.35
VSO= 7.0	RSO= 5.97	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
42-MO-102	*	1.856E+01	6.452E-01	1.419E+00	8.145E+00	2.520E+00
42-MO-103		2.175E+01	5.300E-01	5.321E+00	5.655E+00	1.280E+00
42-MO-104	*	1.825E+01	6.403E-01	1.076E+00	7.922E+00	2.530E+00
42-MO-105	*	1.809E+01	6.379E-01	6.674E+00	6.554E+00	1.280E+00
43-TC-103		1.810E+01	6.310E-01	6.436E+00	6.379E+00	1.240E+00
43-TC-104		1.600E+01	5.500E-01	7.030E+00	2.960E+00	0.0
43-TC-105	*	1.843E+01	6.379E-01	8.330E+00	6.667E+00	1.250E+00
43-TC-106	*	1.826E+01	6.355E-01	5.237E+01	5.297E+00	0.0
44-RU-104		1.650E+01	6.780E-01	8.593E-01	7.878E+00	2.520E+00
44-RU-105		2.025E+01	6.060E-01	1.144E+01	6.747E+00	1.280E+00
44-RU-106		1.870E+01	6.300E-01	1.097E+00	7.896E+00	2.530E+00
44-RU-107		2.030E+01	6.000E-01	1.043E+01	6.637E+00	1.280E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 4.125 FOR RU-106 AND 5.0 FOR RU-107.

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MAT number = 4525

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 45-RH-103 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-SEP90 REV2-FEB94
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.
94-02 JENDL-3.2 WAS MADE BY JNDC FPND W.G.

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)       RESOLVED AND UNRESOLVED RESONACE PARAMETERS
      (3,1), (3,2), (3,4), (3,51-91), (3,102), (3,251)
      (4,2), (4,51-91)
         NEW OMP WAS DETERMINED AND RENORMALIZATION OF CAPTURE
         CROSS SECTION WAS MADE.
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MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 3.58 KEV
    RESONANCE PARAMETERS WERE MAINLY TAKEN FROM JENDL-2.
       EVALUATION PROCEDURE OF JENDL-2 IS AS FOLLOWS:
    RESONANCE ENERGIES AND NEUTRON WIDTHS WERE DETERMINED FROM THE
    EXPERIMENTAL DATA OF RIBON ET AL./3/ AND FRICKE AND CARLSON
    /4/.  TOTAL SPIN J WAS TAKEN FROM HASTE AND THOMAS/5/ BELOW
    1.2 KEV, RIBON ET AL. UP TO 2.63 KEV, AND MACKLIN AND
    HALPERIN/6/ ABOVE 2.65 KEV.  RADIATION WIDTHS WERE EVALUATED
    FROM THE DATA OF RIBON ET AL. AND OF FRICKE AND CARLSON BELOW
    2.65 KEV.  ABOVE 2.65 KEV, RADIATION WIDTH WAS DETERMINED SO
    AS TO REPRODUCE THE CAPTURE AREAS OF MACKLIN AND HALPERIN/6/
    CORRECTED ACOCORDING TO A CORRIGENDUM /7/.  FOR LEVELS WHOSE
    RADIATION WIDTH BECAME NEGATIVE, NEUTRON WIDTH WAS CALCULATED
    FROM THE CAPTURE AREAS OF MACKLIN AND HALPERIN, ASSUMING THE
    RADIATION WIDTH OF 0.16 EV/8/.  AVERAGE RADIATION WIDTH OF
    0.160+-0.013 EV/8/ WAS ASSUMED FOR THE LEVELS HAVING NO DATA
    ON RADIATION WIDTH.  THE EFFECTIVE SCATTERING RADIUS OF 6.2 FM
    WAS TAKEN FROM REF./8/.
       FOR JENDL-3, TOTAL SPIN J OF SOME RESONANCES WAS TENTATIVE-
    LY ESTIMATED WITH A RANDOM NUMBER METHOD.  ABOVE 2.65 KEV,
    NEUTRON WIDTHS WERE RE-ADJUSTED TO REPRODUCE THE CAPTURE AREA
    DATA OF MACKIN AND HALPERIN/6/.
       FOR JENDL-3.2, RADIATION WIDTH LARGER THAN 0.48 EV WAS
    FIXED TO 0.48 EV AND NEUTRON WIDTH WAS RE-ADJUSTED SO AS TO
    REPRODUCE THE CAPTURE AREA DATA.

  UNRESOLVED RESONANCE REGION : 3.58 KEV - 100 KEV
    THE PARAMETERS WERE ADJUSTED TO REPRODUCE THE CAPTURE CROSS
    SECTION CALCULATED WITH CASTHY/9/.  THE EFFECTIVE SCATTERING
    RADIUS WAS OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS
    SECTION AT 100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.440E-4, S1 = 4.100E-4, S2 = 0.530E-4, SG = 71.8E-4,
    GG = 0.230 EV, R  = 6.521 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                    2200 M/S               RES. INTEG.
      TOTAL        149.858                    -
      ELASTIC        3.260                    -
      CAPTURE      146.598                  1040

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/10/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.

  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1(A) WERE DETERMINED TO
  REPRODUCE THE MEASURED TOTAL CROSS SECTIONS, AND USED IN THE
  PEGASUS CACULATION.  THE OMP'S FOR CHARGED PARTICLES ARE AS
  FOLLOWS:
     PROTON   = PEREY/11/
     ALPHA    = HUIZENGA AND IGO/12/
     DEUTERON = LOHR AND HAEBERLI/13/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/14/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/15/ WERE EVALUATED BY IIJIMA ET AL./16/  MORE
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  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /17/.

  ANOTHER SET OF OMP OF NEUTRONS GIVEN IN TABLE 1(B) WAS DETER-
  MINED FOR JENDL-3.2 SO AS TO REPRODUCE BETTER THE TOTAL CROSS
  SECTION.  THIS SET OF OMP WAS USED IN CASTHY CALCULATION FOR
  JENDL-3.2.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WITH OMP IN TABLE 1(B)
    WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY AND OMP IN TABLE 1(B) WAS ADOPTED.  THE LEVEL SCHEME
    WAS TAKEN FROM REF./18/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0            1/2 -
            1        0.0397         7/2 +
            2        0.0930         9/2 +
            3        0.2950         3/2 -
            4        0.3575         5/2 -
            5        0.5368         5/2 +
            6        0.6076         7/2 +
            7        0.6501         7/2 +
            8        0.6518         3/2 +
            9        0.8036         3/2 -
           10        0.8477         7/2 -
           11        0.8804         5/2 -
           12        0.9200         9/2 -
      LEVELS ABOVE 0.96 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY AND THE OMP IN TABLE 1(B) WAS ADOPTED.  DIRECT AND
    SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO
    THE PROCEDURE OF BENZI AND REFFO/19/ AND NORMALIZED TO 1
    MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (6.67E-03) WAS ADJUSTED TO
    REPRODUCE THE CAPTURE CROSS SECTION OF 295 MILLI-BARNS AT 250
    KEV MEASURED BY MACKLIN ET AL./20,7/ THE PRESENT RESULTS
    ARE SLIGHTLY LARGER THAN DATA OF WISSHAK ET AL./21/ AT THE
    ENERGIES FROM 20 TO 200 KEV.

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT = 32  (N,N'D) CROSS SECTION
  MT = 33  (N,N'T) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =106  (N,HE3) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (= 111.5) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/22/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,P)          17.00  MB (RECOMMENDED BY FORREST/23/)
      (N,ALPHA)      11.00  MB (RECOMMENDED BY FORREST)
    THE (N,2N) CROSS SECTION WAS DETERMINED BY EYE-GUIDING OF THE
    DATA MEASURED BY FREHAUT ET AL./24/ AND VEESER ET AL./25/

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
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GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING FROM OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1(A) NEUTRON OPTICAL POTENTIAL PARAMETERS

	DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V	= 47.5	R0 = 5.972	A0 = 0.62
WS	= 9.74	RS = 6.594	AS = 0.35
VSO	= 7.0	RSO= 5.97	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 1(B) NEUTRON OPTICAL POTENTIAL PARAMETERS FOR JENDL-3.2

	DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V	= 48.81-0.4396E	R0 = 1.234	A0 = 0.665
WS	= 8.106+0.4862E	RS = 1.421	AS = 0.377
VSO	= 5.633	RSO= 1.241	ASO= 0.50

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.
RADIUS PARAMETERS ARE COEFFICIENTS OF A**(1/3) TERMS.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
43-TC- 99		1.600E+01	6.550E-01	2.973E+00	5.984E+00	1.290E+00
43-TC-100		1.637E+01	5.850E-01	1.189E+01	3.635E+00	0.0
43-TC-101		1.675E+01	6.440E-01	6.361E+00	5.761E+00	9.400E-01
43-TC-102		1.761E+01	5.400E-01	1.217E+01	3.317E+00	0.0
44-RU-100		1.520E+01	7.200E-01	7.835E-01	8.078E+00	2.570E+00
44-RU-101		1.726E+01	6.700E-01	7.228E+00	6.836E+00	1.280E+00
44-RU-102		1.643E+01	6.550E-01	8.872E-01	7.106E+00	2.220E+00
44-RU-103		1.890E+01	6.480E-01	1.210E+01	7.110E+00	1.280E+00
45-RH-101	*	1.596E+01	6.476E-01	2.608E+00	5.832E+00	1.290E+00
45-RH-102	*	1.703E+01	6.452E-01	3.197E+01	4.966E+00	0.0
45-RH-103		1.570E+01	6.550E-01	4.298E+00	5.499E+00	9.400E-01
45-RH-104		1.714E+01	5.910E-01	1.771E+01	4.018E+00	0.0

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 6.375 FOR RH-103 AND 5.0 FOR RH-104.

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MAT number = 4531

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 45-RH-105 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (SLBW FORMULA) : BELOW 7.5 EV
    PSEUDO RESONANCES WERE GIVEN AT -5 EV AND 5 EV SO AS TO
    REPRODUCE THE THERMAL CAPTURE CROSS SECTION AND RESONANCE
    INTEGRAL GIVEN BY MUGHABGHAB ET AL./2/

  UNRESOLVED RESONANCE REGION : 7.5 EV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/3/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.  THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS
    OF MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.440E-4, S1 = 4.100E-4, S2 = 0.560E-4, SG = 103.E-4,
    GG = 0.150 EV, R  = 6.208 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL       24820                         -
      ELASTIC      8991                         -
      CAPTURE     15830                       17000

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/4/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING RSO OF IIJIMA-KAWAI POTENTIAL/5/.  THE
  OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/6/
     ALPHA    = HUIZENGA AND IGO/7/
     DEUTERON = LOHR AND HAEBERLI/8/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/9/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/10/ WERE EVALUATED BY IIJIMA ET AL./11/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /12/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/13/ AND NUCLEAR DATA
    SHEETS/14/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0            7/2 +
            1        0.1296         1/2 -
            2        0.1492         9/2 +
            3        0.3925         3/2 -
            4        0.4555         5/2 -
            5        0.4693         3/2 +
            6        0.4740         9/2 +
            7        0.4992         5/2 +
            8        0.6386         7/2 +
            9        0.7243         5/2 +
           10        0.7620         3/2 +
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11	0.7830	1/2 -
12	0.7858	5/2 -
13	0.8058	3/2 +

LEVELS ABOVE 0.817 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/15/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (9.93E-03) WAS DETERMINED FROM THE SYSTEMATICS OF RADIATION WIDTH (0.15 EV) AND THE AVERAGE S-WAVE RESONANCE LEVEL SPACING (15.1 EV) CALCULATED FROM THE LEVEL DENSITY PARAMETERS.

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT = 32 (N,N'D) CROSS SECTION
MT = 33 (N,N'T) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 107.9) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/16/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
(N,P) 13.60 MB (SYSTEMATICS OF FORREST/17/)
(N,ALPHA) 3.24 MB (SYSTEMATICS OF FORREST)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING FROM OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 47.5	R0 = 5.972	A0 = 0.62
WS = 9.74	RS = 6.594	AS = 0.35
VSO= 7.0	RSO= 5.97	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
43-TC-101	1.675E+01	6.440E-01	6.361E+00	5.761E+00	9.400E-01
43-TC-102	1.761E+01	5.400E-01	1.217E+01	3.317E+00	0.0
43-TC-103	1.810E+01	6.310E-01	6.436E+00	6.379E+00	1.240E+00
43-TC-104	1.600E+01	5.500E-01	7.030E+00	2.960E+00	0.0
44-RU-102	1.643E+01	6.550E-01	8.872E-01	7.106E+00	2.220E+00
44-RU-103	1.890E+01	6.480E-01	1.210E+01	7.110E+00	1.280E+00
44-RU-104	1.650E+01	6.780E-01	8.593E-01	7.878E+00	2.520E+00
44-RU-105	2.025E+01	6.060E-01	1.144E+01	6.747E+00	1.280E+00
45-RH-103	1.570E+01	6.550E-01	4.298E+00	5.499E+00	9.400E-01
45-RH-104	1.714E+01	5.910E-01	1.771E+01	4.018E+00	0.0
45-RH-105	1.637E+01	7.110E-01	8.434E+00	7.191E+00	1.240E+00
45-RH-106	1.700E+01	5.300E-01	8.449E+00	2.973E+00	0.0

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 4.615 FOR RH-105 AND 5.0 FOR RH-106.

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MAT number = 4625

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 46-PD-102 JNDC        EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                       DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 0.25 KEV
    RESONANCE PARAMETERS WERE BASED ON MUGHABGHAB ET AL./2/

  UNRESOLVED RESONANCE REGION : 0.25 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTION S1 WAS BASED ON THE SYSTEMATICS
    OF MUGHABGHAB ET AL., AND S0 AND S2 WERE CALCULATED WITH
    OPTICAL MODEL CODE CASTHY/3/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS OF
    MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.800E-4, S1 = 5.000E-4, S2 = 1.000E-4, SG = 9.09E-4,
    GG = 0.150 EV, R  = 4.951 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           8.387                    -
      ELASTIC         5.024                    -
      CAPTURE         3.363                   19.5

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/4/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE THE CD-NATURAL TOTAL CROSS SECTIONS
  MEASURED BY FOSTER AND GLASGOW/5/, POENITZ AND WHALEN/6/ AND
  SO ON, AND APPLIED TO PD ISOTOPES ALSO.  THE OMP'S FOR CHARGED
  PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/7/
     ALPHA    = HUIZENGA AND IGO/8/
     DEUTERON = LOHR AND HAEBERLI/9/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/10/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/11/ WERE EVALUATED BY IIJIMA ET AL./12/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /13/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/14/ AND NUCLEAR DATA
    SHEETS/15/.
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NO.	ENERGY(MEV)	SPIN-PARITY
GR.	0.0	0 +
1	0.5565	2 +
2	1.2760	4 +
3	1.5346	2 +
4	1.5930	0 +
5	1.6582	0 +
6	1.7150	6 +
7	1.9190	3 +
8	1.9444	2 +
9	2.1115	6 +
10	2.1118	3 +

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          11        2.1381          4  +
          12        2.2487          2  +
          13        2.2947          4  -
          14        2.3014          4  +
          15        2.3430          3  +
          16        2.3912          1  +
          17        2.4316          3  +
          18        2.4745          5  -
     LEVELS ABOVE 2.48 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/16/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (9.55E-04) WAS DETERMINED FROM
    THE SYSTEMATICS.

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT = 32  (N,N'D) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =106  (N,HE3) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
  MT =111  (N,2P) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (=  93.4) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/17/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,P)          93.60  MB (RECOMMENDED BY FORREST/18/)
      (N,ALPHA)      19.60  MB (SYSTEMATICS OF FORREST/18/)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING FROM OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
          ----------------------  ------------  ---------------
        V  = 50.01-0.5528E        R0 = 5.972    A0 = 0.56
        WS = 8.165                RS = 6.594    AS = 0.44
        VSO= 5.261                RSO= 5.97     ASO= 0.267
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2  LEVEL DENSITY PARAMETERS

 NUCLIDE   SYST A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
 ---------------------------------------------------------------
 44-RU- 98      1.382E+01 7.400E-01 6.070E-01 7.507E+00 2.400E+00
 44-RU- 99      1.650E+01 6.570E-01 4.016E+00 6.235E+00 1.280E+00
 44-RU-100      1.520E+01 7.200E-01 7.835E-01 8.078E+00 2.570E+00
 44-RU-101      1.726E+01 6.700E-01 7.228E+00 6.836E+00 1.280E+00

 45-RH- 99   *  1.386E+01 6.566E-01 1.354E+00 4.866E+00 1.120E+00
 45-RH-100   *  1.490E+01 6.500E-01 1.162E+01 4.114E+00 0.0
 45-RH-101   *  1.596E+01 6.476E-01 2.608E+00 5.832E+00 1.290E+00
 45-RH-102   *  1.703E+01 6.452E-01 3.197E+01 4.966E+00 0.0

 46-PD-100   *  1.400E+01 6.500E-01 1.679E-01 6.179E+00 2.470E+00
 46-PD-101      1.689E+01 6.410E-01 3.454E+00 6.175E+00 1.350E+00
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46-PD-102     1.831E+01 6.210E-01 6.406E-01 7.665E+00 2.640E+00
46-PD-103     1.733E+01 6.550E-01 5.327E+00 6.637E+00 1.350E+00
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 SYST:  * = LDP'S WERE DETERMINED FROM SYSTEMATICS.
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SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 7.569 FOR PD-102 AND 5.0 FOR PD-103.

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MAT number = 4631

46-PD-104 JNDC EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
DIST-NOV90

HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.

MF = 1 GENERAL INFORMATION
MT=451 COMMENTS AND DICTIONARY

MF = 2 RESONANCE PARAMETERS
MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
RESOLVED RESONANCE REGION (SLBW FORMULA) : BELOW 279 EV
RESONANCE PARAMETERS WERE TAKEN FROM JENDL-2; PARAMETERS OF 182.3-EV RESONANCE WERE TAKEN FROM THE DATA MEASURED BY POPOV ET AL./3/

UNRESOLVED RESONANCE REGION : 279 EV - 100 KEV
THE NEUTRON STRENGTH FUNCTION S1 WAS BASED ON THE COMPILATION OF MUGHABGHAB ET AL./4/, AND S0 AND S2 WERE CALCULATED WITH OPTICAL MODEL CODE CASTHY/5/. THE OBSERVED LEVEL SPACING WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED WITH CASTHY. THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV. THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS OF MEASURED VALUES FOR NEIGHBORING NUCLIDES.

TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
S0 = 0.810E-4, S1 = 5.300E-4, S2 = 1.000E-4, SG = 6.18E-4,
GG = 0.160 EV, R = 4.725 FM.

CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)

	2200 M/S	RES. INTEG.
TOTAL	5.440	-
ELASTIC	4.917	-
CAPTURE	0.5231	21.9

MF = 3 NEUTRON CROSS SECTIONS
BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED WITH PEGASUS/6/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL. THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE DETERMINED TO REPRODUCE THE CD-NATURAL TOTAL CROSS SECTIONS MEASURED BY FOSTER AND GLASGOW/7/, POENITZ AND WHALEN/8/ AND SO ON, AND APPLIED TO PD ISOTOPES TOO. THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
PROTON = PEREY/9/
ALPHA = HUIZENGA AND IGO/10/
DEUTERON = LOHR AND HAEBERLI/11/
HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/12/
PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT AND CAMERON/13/ WERE EVALUATED BY IIJIMA ET AL./14/ MORE EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE PRESENT WORK. TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED IN THE PRESENT CALCULATION. ENERGY DEPENDENCE OF SPIN CUT-OFF PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR /15/.

MT = 1 TOTAL
SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

MT = 2 ELASTIC SCATTERING
CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

MT = 4, 51 - 91 INELASTIC SCATTERING
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS ADOPTED. THE LEVEL SCHEME WAS TAKEN FROM REF./16/.

NO.	ENERGY(MEV)	SPIN-PARITY	DWBA-CAL
GR.	0.0	0 +	
1	0.5558	2 +	*
2	1.3236	4 +	
3	1.3336	0 +	
4	1.3417	2 +	
5	1.7929	0 +	
6	1.7938	2 +	
7	1.8207	3 +	
8	1.9416	5 +	
9	2.0824	4 +	

LEVELS ABOVE 2.2 MEV WERE ASSUMED TO BE OVERLAPPING.

FOR THE LEVELS WITH AN ASTERISK, THE CONTRIBUTION OF DIRECT INELASTIC SCATTERING CROSS SECTIONS WAS CALCULATED BY THE DWUCK-4 CODE/17/. DEFORMATION PARAMETER (BETA2 = 0.209) WAS BASED ON THE DATA COMPILED BY RAMAN ET AL./18/

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY/5/ WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/19/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (6.50E-4) WAS ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION OF 220 MILLI-BARNS AT 50 KEV MEASURED BY CORNELIS ET AL./20/

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT = 32 (N,N'D) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =106 (N,HE3) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 89.7) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/21/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,P)	58.00 MB	(RECOMMENDED BY FORREST/22/)
(N,ALPHA)	10.40 MB	(SYSTEMATICS OF FORREST/22/)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. CONTRIBUTION OF DIRECT INELASTIC SCATTERING WAS CALCULATED WITH DWUCK-4. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING FROM OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 50.01-0.5528E	R0 = 5.972	A0 = 0.56
WS = 8.165	RS = 6.594	AS = 0.44
VSO= 5.261	RSO= 5.97	ASO= 0.267

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
44-RU-100		1.520E+01	7.200E-01	7.835E-01	8.078E+00	2.570E+00
44-RU-101		1.726E+01	6.700E-01	7.228E+00	6.836E+00	1.280E+00
44-RU-102		1.643E+01	6.550E-01	8.872E-01	7.106E+00	2.220E+00
44-RU-103		1.890E+01	6.480E-01	1.210E+01	7.110E+00	1.280E+00
45-RH-101	*	1.596E+01	6.476E-01	2.608E+00	5.832E+00	1.290E+00
45-RH-102	*	1.703E+01	6.452E-01	3.197E+01	4.966E+00	0.0
45-RH-103		1.570E+01	6.550E-01	4.298E+00	5.499E+00	9.400E-01
45-RH-104		1.714E+01	5.910E-01	1.771E+01	4.018E+00	0.0
46-PD-102		1.831E+01	6.210E-01	6.406E-01	7.665E+00	2.640E+00
46-PD-103		1.733E+01	6.550E-01	5.327E+00	6.637E+00	1.350E+00
46-PD-104		1.630E+01	6.650E-01	8.743E-01	7.305E+00	2.290E+00
46-PD-105		1.791E+01	6.700E-01	9.137E+00	7.207E+00	1.350E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 5.680 FOR PD-104 AND 6.279 FOR PD-105.

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MAT number = 4634

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 46-PD-105 JNDC        EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                       DIST-NOV90 REV1-AUG91
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.
91-08 TOTAL SPIN OF RESONANCES WAS MODIFIED.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 2.0485 KEV
    RESONANCE PARAMETERS WERE MAINLY TAKEN FROM JENDL-2.
       EVALUATION FOR JENDL-2 WAS MADE ON THE BASIS OF DATA
    MEASURED BY STAVELOZ ET AL./3/  DATA BY BOLLINGER ET AL./4/
    AND BY COCEVA ET AL./5/ WERE ALSO TAKEN INTO ACCOUNT TO
    DETERMINE THE ANGULAR MOMENTUM L AND THE SPIN J.  THE AVERAGE
    RADIATION WIDTH OF 0.15 EV WAS ASSUMED FOR S-WAVE LEVELS.  TWO
    NEGATIVE RESONANCES WERE ADDED SO AS TO REPRODUCE THE THERMAL
    CAPTURE AND SCATTERING CROSS SECTIONS GIVEN BY MUGHABGHAB ET
    AL./6/
       FOR JENDL-3, TOTAL SPIN J OF SOME RESONANCES WAS TENTATIVE-
    LY ESTIMATED WITH A RANDOM NUMBER METHOD.  NEUTRON ORBITAL
    ANGULAR MOMENTUM L OF SOME RESONANCES WAS ESTIMATED WITH A
    METHOD OF BOLLINGER AND THOMAS/7/.

  UNRESOLVED RESONANCE REGION : 2.0485 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0 AND S1 WERE BASED ON THE
    COMPILATION OF MUGHABGHAB ET AL., AND S2 WERE CALCULATED WITH
    OPTICAL MODEL CODE CASTHY/8/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH GG WAS BASED ON THE COMPILATION OF
    MUGHABGHAB ET AL.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.600E-4, S1 = 5.800E-4, S2 = 0.980E-4, SG = 155.E-4,
    GG = 0.145 EV, R  = 4.600 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                   2200 M/S               RES. INTEG.
      TOTAL        25.36                    -
      ELASTIC       5.116                   -
      CAPTURE      20.25                   96.8

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/9/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE THE CD-NATURAL TOTAL CROSS SECTIONS
  MEASURED BY FOSTER AND GLASGOW/10/, POENITZ AND WHALEN/11/ AND
  SO ON, AND APPLIED TO PD ISOTOPES.  THE OMP'S FOR CHARGED
  PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/12/
     ALPHA    = HUIZENGA AND IGO/13/
     DEUTERON = LOHR AND HAEBERLI/14/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/15/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/16/ WERE EVALUATED BY IIJIMA ET AL./17/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /18/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./19/.

           NO.      ENERGY(MEV)    SPIN-PARITY
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          GR.       0.0          5/2 +
           1        0.2805       3/2 +
           2        0.3063       7/2 +
           3        0.3192       5/2 +
           4        0.3445       1/2 +
           5        0.4422       7/2 +
           6        0.4891      11/2 -
           7        0.5608       5/2 +
           8        0.6445       7/2 -
           9        0.6507       3/2 +
          10        0.6732       1/2 +
          11        0.6940       7/2 +
          12        0.7272       5/2 +
          13        0.7813       9/2 +
          14        0.7870       1/2 +
          15        0.9294       7/2 +
          16        0.9390       1/2 +
          17        0.9624       1/2 +
          18        0.9702      15/2 -
          19        0.9790       5/2 +
          20        1.0118      11/2 +
          21        1.0722       5/2 +
          22        1.0750       1/2 +
          23        1.0879       3/2 -
          24        1.0984       5/2 +
          25        1.1410       1/2 +
     LEVELS ABOVE 1.15 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/20/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (1.86E-02) WAS ADJUSTED TO
    REPRODUCE THE CAPTURE CROSS SECTION OF 680 MILLI-BARNS AT 100
    KEV MEASURED BY MACKLIN ET AL./21,22/

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT = 32  (N,N'D) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =106  (N,HE3) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (= 104.7) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/23/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,P)         32.00  MB (RECOMMENDED BY FORREST/24/)
      (N,ALPHA)      7.39  MB (SYSTEMATICS OF FORREST/24/)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING FROM OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

             DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
         ----------------------  ------------  ---------------
        V  = 50.01-0.5528E       R0 = 5.972    A0 = 0.56
        WS = 8.165               RS = 6.594    AS = 0.44
        VSO= 5.261               RSO= 5.97     ASO= 0.267
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THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
44-RU-101		1.726E+01	6.700E-01	7.228E+00	6.836E+00	1.280E+00
44-RU-102		1.643E+01	6.550E-01	8.872E-01	7.106E+00	2.220E+00
44-RU-103		1.890E+01	6.480E-01	1.210E+01	7.110E+00	1.280E+00
44-RU-104		1.650E+01	6.780E-01	8.593E-01	7.878E+00	2.520E+00
45-RH-102	*	1.703E+01	6.452E-01	3.197E+01	4.966E+00	0.0
45-RH-103		1.570E+01	6.550E-01	4.298E+00	5.499E+00	9.400E-01
45-RH-104		1.714E+01	5.910E-01	1.771E+01	4.018E+00	0.0
45-RH-105		1.637E+01	7.110E-01	8.434E+00	7.191E+00	1.240E+00
46-PD-103		1.733E+01	6.550E-01	5.327E+00	6.637E+00	1.350E+00
46-PD-104		1.630E+01	6.650E-01	8.743E-01	7.305E+00	2.290E+00
46-PD-105		1.791E+01	6.700E-01	9.137E+00	7.207E+00	1.350E+00
46-PD-106		1.717E+01	6.660E-01	8.922E-01	8.024E+00	2.590E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 6.279 FOR PD-105 AND 6.429 FOR PD-106.

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MAT number = 4637

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 46-PD-106 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (SLBW FORMULA) : BELOW 423 EV
    PARAMETERS OF A POSITIVE LEVEL WERE TAKEN FROM JENDL-2 WHICH
    WERE EVALUATED ON THE BASIS OF MEASURED DATA BY POPOV ET AL.
    /3/  A NEGATIVE RESONANCE WAS ADDED SO AS TO REPRODUCE THE
    CAPTURE AND ELASTIC SCATTERING CROSS SECTIONS AT 0.0253 EV
    GIVEN BY MUGHABGHAB ET AL./4/ SCATTERING RADIUS OF 6.5 FM WAS
    ADOPTED.

  UNRESOLVED RESONANCE REGION : 423 EV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0 AND S1 WERE BASED ON THE
    COMPILATION OF MUGHABGHAB ET AL./4/, AND S2 WAS CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/5/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.  THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS
    OF MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.340E-4, S1 = 5.200E-4, S2 = 0.970E-4, SG = 6.33E-4,
    GG = 0.177 EV, R  = 5.280 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                   2200 M/S               RES. INTEG.
      TOTAL         5.304                    -
      ELASTIC       5.001                    -
      CAPTURE       0.3030                    9.31

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/6/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE THE CD-NATURAL TOTAL CROSS SECTIONS
  MEASURED BY FOSTER AND GLASGOW/7/, POENITZ AND WHALEN/8/ AND
  SO ON, AND APPLIED TO PD ISOTOPES.  THE OMP'S FOR CHARGED
  PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/9/
     ALPHA    = HUIZENGA AND IGO/10/
     DEUTERON = LOHR AND HAEBERLI/11/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/12/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/13/ WERE EVALUATED BY IIJIMA ET AL./14/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /15/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./16/.

           NO.      ENERGY(MEV)    SPIN-PARITY   DWBA CAL.
           GR.       0.0             0  +
            1        0.5118          2  +           *
            2        1.1280          2  +
            3        1.1336          0  +
            4        1.2292          4  +
            5        1.5580          3  +
            6        1.5621          2  +
            7        1.7061          0  +
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8	1.9104	2	+	
9	1.9323	4	+	
10	2.0012	0	+	
11	2.0761	6	+	
12	2.0774	4	+	
13	2.0843	3	-	*
14	2.2424	2	+	
15	2.2780	0	+	
16	2.2829	4	+	
17	2.3060	4	-	
18	2.3086	2	+	
19	2.3508	4	+	
20	2.3660	4	+	
21	2.3973	5	-	
22	2.4014	3	-	
23	2.4386	2	+	

LEVELS ABOVE 2.5 MEV WERE ASSUMED TO BE OVERLAPPING.

FOR THE LEVELS WITH AN ASTERISK, THE CONTRIBUTION OF DIRECT INELASTIC SCATTERING CROSS SECTIONS WAS CALCULATED BY THE DWUCK-4 CODE/17/. DEFORMATION PARAMETERS (BETA2 = 0.229 AND BETA3 = 0.170) WERE BASED ON THE DATA COMPILED BY RAMAN ET AL./18/ AND SPEAR/19/, RESPECTIVELY.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/20/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (6.32E-04) WAS ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION OF 308 MILLI-BARNS AT 30 KEV MEASURED BY MACKLIN ET AL./21,22/

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 77.5) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/23/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,P)	23.00 MB	(RECOMMENDED BY FORREST/24/)
(N,ALPHA)	5.60 MB	(RECOMMENDED BY FORREST)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. CONTRIBUTION OF DIRECT INELASTIC SCATTERING WAS CALCULATED WITH DWUCK-4. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING FROM OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 50.01-0.5528E	R0 = 5.972	A0 = 0.56
WS = 8.165	RS = 6.594	AS = 0.44
VSO= 5.261	RSO= 5.97	ASO= 0.267

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING

44-RU-102	1.643E+01	6.550E-01	8.872E-01	7.106E+00	2.220E+00
44-RU-103	1.890E+01	6.480E-01	1.210E+01	7.110E+00	1.280E+00
44-RU-104	1.650E+01	6.780E-01	8.593E-01	7.878E+00	2.520E+00
44-RU-105	2.025E+01	6.060E-01	1.144E+01	6.747E+00	1.280E+00
45-RH-103	1.570E+01	6.550E-01	4.298E+00	5.499E+00	9.400E-01
45-RH-104	1.714E+01	5.910E-01	1.771E+01	4.018E+00	0.0
45-RH-105	1.637E+01	7.110E-01	8.434E+00	7.191E+00	1.240E+00
45-RH-106	1.700E+01	5.300E-01	8.449E+00	2.973E+00	0.0
46-PD-104	1.630E+01	6.650E-01	8.743E-01	7.305E+00	2.290E+00
46-PD-105	1.791E+01	6.700E-01	9.137E+00	7.207E+00	1.350E+00
46-PD-106	1.717E+01	6.660E-01	8.922E-01	8.024E+00	2.590E+00
46-PD-107	1.916E+01	6.110E-01	6.467E+00	6.507E+00	1.350E+00

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 6.429 FOR PD-106 AND 4.350 FOR PD-107.

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MAT number = 4640

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 46-PD-107 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-SEP90 REV2-MAR93
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.
93-03 JENDL-3.2 WAS MADE BY JNDC FPND W.G.

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)       THE UPPER BOUNDARY OF RESOLVED RESONANCE
                    REGION WAS CHANGED FROM 3.525 KEV TO 1 KEV
     ***********************************************************


MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 1.0 KEV
    RESONANCE PARAMETERS OF JENDL-2 WERE REEVALUATED AS FOLLOWS:
       FOR JENDL-2, RESONANCE ENERGIES WERE BASED ON THE DATA BY
    MACKLIN/3/.  NEUTRON WIDTHS WERE TAKEN FROM EXPERIMENTAL DATA
    OF SINGH ET AL./4/ AND MACKLIN/3/.  THE AVERAGE RADIATION
    WIDTH OF 0.125 EV/4/ WAS ASSUMED.
       FOR JENDL-3, THE RESONANCE ENERGIES WERE ADOPTED FROM
    JENDL-2.  NEUTRON WIDTHS WERE TAKEN FROM THE MEASUREMENT OF
    ANUFRIEV ET AL./5/ OR DETERMINED FROM THE CAPTURE AREA DATA
    MEASURED BY MACKLIN/6/ AND AN AVERAGED RADIATION WIDTH OF
    131+-69 MEV.  RADIATION WIDTHS OF RESONANCES WHOSE NEUTRON
    WIDTH WAS MEASURED BY ANUFRIEV ET AL./5/ WERE DETERMINED
    FROM THE DATA OF THE CAPTURE AREA MEASURED BY MACKLIN/6/ AND
    THE NEUTRON WIDTH/5/.  TOTAL SPIN J OF SOME RESONANCES WAS
    TENTATIVELY ESTIMATED WITH A RANDOM NUMBER METHOD.  NEUTRON
    ORBITAL ANGULAR MOMENTUM L OF SOME RESONANCES WAS ESTIMATED
    WITH A METHOD OF BOLLINGER AND THOMAS/7/.

  UNRESOLVED RESONANCE REGION : 1.000 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/8/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.  THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS
    OF MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.810E-4, S1 = 3.030E-4, S2 = 0.960E-4, SG = 220.E-4,
    GG = 0.125 EV, R  = 6.025 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S                RES. INTEG.
      TOTAL           5.326                     -
      ELASTIC         3.318                     -
      CAPTURE         2.008                    112

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/9/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE THE CD-NATURAL TOTAL CROSS SECTIONS
  MEASURED BY FOSTER AND GLASGOW/10/, POENITZ AND WHALEN/11/ AND
  SO ON, AND APPLIED TO PD ISOTOPES.  THE OMP'S FOR CHARGED
  PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/12/
     ALPHA    = HUIZENGA AND IGO/13/
     DEUTERON = LOHR AND HAEBERLI/14/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/15/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/16/ WERE EVALUATED BY IIJIMA ET AL./17/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /18/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.
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MT = 2  ELASTIC SCATTERING
  CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

MT = 4, 51 - 91  INELASTIC SCATTERING
  SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
  ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./19/.

         NO.      ENERGY(MEV)    SPIN-PARITY
         GR.       0.0             5/2 +
          1        0.1157          1/2 +
          2        0.2140         11/2 -
          3        0.3028          5/2 +
          4        0.3122          7/2 +
          5        0.3482          1/2 +
          6        0.3660          9/2 +
          7        0.3819          3/2 +
          8        0.3924          7/2 +
          9        0.4120          1/2 +
         10        0.4712          3/2 +
         11        0.5677          5/2 +
         12        0.6701          5/2 +
         13        0.6850          7/2 -
         14        0.6980          1/2 +
         15        0.7590          3/2 +
         16        0.7810          3/2 -
         17        0.8060          3/2 -
         18        0.8090          5/2 +
         19        0.8890          1/2 +
         20        1.0230          3/2 +
    LEVELS ABOVE 1.03 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102  CAPTURE
  SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
  CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
  SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
  AND REFFO/20/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

  THE GAMMA-RAY STRENGTH FUNCTION (2.17E-02) WAS ADJUSTED TO
  REPRODUCE THE CAPTURE CROSS SECTION OF 750 MILLI-BARNS AT 100
  KEV MEASURED BY MACKLIN ET AL./21/

MT = 16  (N,2N) CROSS SECTION
MT = 17  (N,3N) CROSS SECTION
MT = 22  (N,N'A) CROSS SECTION
MT = 28  (N,N'P) CROSS SECTION
MT = 32  (N,N'D) CROSS SECTION
MT =103  (N,P) CROSS SECTION
MT =104  (N,D) CROSS SECTION
MT =105  (N,T) CROSS SECTION
MT =107  (N,ALPHA) CROSS SECTION
  THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
  PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

  THE KALBACH'S CONSTANT K (=  97.8) WAS ESTIMATED BY THE
  FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/22/ AND LEVEL
  DENSITY PARAMETERS.

  FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
  NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
    (N,P)          15.90  MB (SYSTEMATICS OF FORREST/23/)
    (N,ALPHA)       3.64  MB (SYSTEMATICS OF FORREST)

MT = 251  MU-BAR
  CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING FROM OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
         ----------------------  ------------  ---------------
        V  = 50.01-0.5528E        R0 = 5.972    A0 = 0.56
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WS = 8.165 RS = 6.594 AS = 0.44
VSO= 5.261 RSO= 5.97 ASO= 0.267
THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
44-RU-103		1.890E+01	6.480E-01	1.210E+01	7.110E+00	1.280E+00
44-RU-104		1.650E+01	6.780E-01	8.593E-01	7.878E+00	2.520E+00
44-RU-105		2.025E+01	6.060E-01	1.144E+01	6.747E+00	1.280E+00
44-RU-106		1.870E+01	6.300E-01	1.097E+00	7.896E+00	2.530E+00
45-RH-104		1.714E+01	5.910E-01	1.771E+01	4.018E+00	0.0
45-RH-105		1.637E+01	7.110E-01	8.434E+00	7.191E+00	1.240E+00
45-RH-106		1.700E+01	5.300E-01	8.449E+00	2.973E+00	0.0
45-RH-107		1.963E+01	5.480E-01	3.151E+00	5.336E+00	1.250E+00
46-PD-105		1.791E+01	6.700E-01	9.137E+00	7.207E+00	1.350E+00
46-PD-106		1.717E+01	6.660E-01	8.922E-01	8.024E+00	2.590E+00
46-PD-107		1.916E+01	6.110E-01	6.467E+00	6.507E+00	1.350E+00
46-PD-108		1.790E+01	6.460E-01	8.844E-01	7.957E+00	2.600E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 4.350 FOR PD-107 AND 5.875 FOR PD-108.

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MAT number = 4643

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 46-PD-108 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 9 KEV
    RESONANCE PARAMETERS ARE THE SAME AS JENDL-2 WHICH WERE MAINLY
    TAKEN FROM THE RECOMMENDATION BY MUGHABGHAB ET AL./3/  THE
    AVERAGE RADIATION WIDTH OF 0.077 EV/3/ WAS ASSUMED.

  UNRESOLVED RESONANCE REGION : 9 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0 AND S1 WERE BASED ON THE
    COMPILATION OF MUGHABGHAB ET AL./3/, AND S2 WAS CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/4/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.  THE RADIATION WIDTH GG WAS BASED ON THE COMPILATION
    OF MUGHABGHAB ET AL.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.780E-4, S1 = 4.400E-4, S2 = 0.950E-4, SG = 5.00E-4,
    GG = 0.077 EV, R  = 5.256 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S              RES. INTEG.
      TOTAL          10.42                     -
      ELASTIC         1.921                    -
      CAPTURE         8.504                   252

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/5/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE THE CD-NATURAL TOTAL CROSS SECTIONS
  MEASURED BY FOSTER AND GLASGOW/6/, POENITZ AND WHALEN/7/ AND
  SO ON, AND APPLIED TO PD ISOTOPES.  THE OMP'S FOR CHARGED
  PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/8/
     ALPHA    = HUIZENGA AND IGO/9/
     DEUTERON = LOHR AND HAEBERLI/10/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/11/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/12/ WERE EVALUATED BY IIJIMA ET AL./13/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /14/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./15/.

           NO.      ENERGY(MEV)    SPIN-PARITY    DWBA CAL.
           GR.        0.0            0  +
            1         0.4340         2  +             *
            2         0.9312         2  +
            3         1.0483         4  +
            4         1.0528         0  +
            5         1.3142         0  +
            6         1.3356         3  +
            7         1.4411         2  +
            8         1.5400         1  +
            9         1.7710         6  +
           10         2.0460         3  -             *
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          11        2.1410          0  +
          12        2.2140          2  +
          13        2.2825          5  +
          14        2.3180          5  -
          15        2.3620          2  +
          16        2.3920          2  +
     LEVELS ABOVE 2.44 MEV WERE ASSUMED TO BE OVERLAPPING.

   FOR THE LEVELS WITH AN ASTERISK, THE CONTRIBUTION OF DIRECT
   INELASTIC SCATTERING CROSS SECTIONS WAS CALCULATED BY THE
   DWUCK-4 CODE/16/.  DEFORMATION PARAMETERS (BETA2 = 0.243 AND
   BETA3 = 0.150) WERE BASED ON THE DATA COMPILED BY RAMAN ET
   AL./17/ AND SPEAR/18/, RESPECTIVELY.

 MT = 102  CAPTURE
   SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
   CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
   SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
   AND REFFO/19/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

   THE GAMMA-RAY STRENGTH FUNCTION (4.98E-04) WAS ADJUSTED TO
   REPRODUCE THE CAPTURE CROSS SECTION OF 258 MILLI-BARNS AT 30
   KEV MEASURED BY MACKLIN ET AL./20,21/

 MT = 16  (N,2N) CROSS SECTION
 MT = 17  (N,3N) CROSS SECTION
 MT = 22  (N,N'A) CROSS SECTION
 MT = 28  (N,N'P) CROSS SECTION
 MT =103  (N,P) CROSS SECTION
 MT =104  (N,D) CROSS SECTION
 MT =105  (N,T) CROSS SECTION
 MT =107  (N,ALPHA) CROSS SECTION
   THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
   PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

   THE KALBACH'S CONSTANT K (=  64.9) WAS ESTIMATED BY THE
   FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/22/ AND LEVEL
   DENSITY PARAMETERS.

   FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
   NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
     (N,P)         11.20  MB (SYSTEMATICS OF FORREST/23/)
     (N,ALPHA)      2.60  MB (RECOMMENDED BY FORREST/23/)

 MT = 251  MU-BAR
   CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  CONTRIBUTION OF DIRECT INELASTIC
  SCATTERING WAS CALCULATED WITH DWUCK-4.  FOR OTHER REACTIONS,
  ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING FROM OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.
```

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 50.01-0.5528E	R0 = 5.972	A0 = 0.56
WS = 8.165	RS = 6.594	AS = 0.44
VSO= 5.261	RSO= 5.97	ASO= 0.267

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
44-RU-104		1.650E+01	6.780E-01	8.593E-01	7.878E+00	2.520E+00
44-RU-105		2.025E+01	6.060E-01	1.144E+01	6.747E+00	1.280E+00
44-RU-106		1.870E+01	6.300E-01	1.097E+00	7.896E+00	2.530E+00
44-RU-107		2.030E+01	6.000E-01	1.043E+01	6.637E+00	1.280E+00
45-RH-105		1.637E+01	7.110E-01	8.434E+00	7.191E+00	1.240E+00
45-RH-106		1.700E+01	5.300E-01	8.449E+00	2.973E+00	0.0
45-RH-107		1.963E+01	5.480E-01	3.151E+00	5.336E+00	1.250E+00
45-RH-108	*	1.861E+01	6.306E-01	5.818E+01	5.341E+00	0.0

46-PD-106	1.717E+01	6.660E-01	8.922E-01	8.024E+00	2.590E+00
46-PD-107	1.916E+01	6.110E-01	6.467E+00	6.507E+00	1.350E+00
46-PD-108	1.790E+01	6.460E-01	8.844E-01	7.957E+00	2.600E+00
46-PD-109	2.071E+01	6.030E-01	1.194E+01	6.925E+00	1.350E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 5.875 FOR PD-108 AND 5.0 FOR PD-109.

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MAT number = 4649

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 46-PD-110 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 8 KEV
    RESONANCE PARAMETERS ARE THE SAME AS JENDL-2 WHICH WERE MAINLY
    TAKEN FROM THE RECOMMENDATION BY MUGHABGHAB ET AL./3/ AVERAGE
    RADIATION WIDTH OF 0.06 EV/3/ WAS ASSUMED.  A NEGATIVE
    RESONANCE WAS ADDED AT -20 EV SO AS TO REPRODUCE THE THERMAL
    CAPTURE CROSS SECTIONS GIVEN BY MUGHABGHAB ET AL.

  UNRESOLVED RESONANCE REGION : 8 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTION S1 WAS BASED ON THE COMPILATION
    OF MUGHABGHAB ET AL./3/, AND S0 AND S2 WERE CALCULATED WITH
    OPTICAL MODEL CODE CASTHY/4/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH GG WAS BASED ON THE COMPILATION OF
    MUGHABGHAB ET AL.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.810E-4, S1 = 6.000E-4, S2 = 0.950E-4, SG = 2.64E-4,
    GG = 0.060 EV, R  = 4.124 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           5.222                    -
      ELASTIC         4.995                    -
      CAPTURE         0.2270                    2.82

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY/4/, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/5/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE THE CD-NATURAL TOTAL CROSS SECTIONS
  MEASURED BY FOSTER AND GLASGOW/6/, POENITZ AND WHALEN/7/ AND
  SO ON, AND APPLIED TO PD ISOTOPES.  THE OMP'S FOR CHARGED
  PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/8/
     ALPHA    = HUIZENGA AND IGO/9/
     DEUTERON = LOHR AND HAEBERLI/10/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/11/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/12/ WERE EVALUATED BY IIJIMA ET AL./13/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /14/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./15/.
```

NO.	ENERGY(MEV)	SPIN-PARITY	DWBA CAL.
GR.	0.0	0 +	
1	0.3738	2 +	*
2	0.8138	2 +	
3	0.9205	4 +	
4	0.9463	0 +	
5	1.1710	0 +	
6	1.2124	3 +	
7	1.2145	2 +	
8	1.3980	4 +	

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          9         1.4701           1  +
         10         1.5739           6  +
    LEVELS ABOVE 1.67 MEV WERE ASSUMED TO BE OVERLAPPING.

      FOR THE LEVELS WITH AN ASTERISK, THE CONTRIBUTION OF DIRECT
      INELASTIC SCATTERING CROSS SECTIONS WAS CALCULATED BY THE
      DWUCK-4 CODE/16/.  DEFORMATION PARAMETER (BETA2 = 257) WAS
      BASED ON THE DATA COMPILED BY RAMAN ET AL./17/

    MT = 102  CAPTURE
      SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
      CASTHY/4/ WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
      SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
      AND REFFO/18/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

      THE GAMMA-RAY STRENGTH FUNCTION (2.65E-4) WAS ADJUSTED TO
      REPRODUCE THE CAPTURE CROSS SECTION OF 80.0 MILLI-BARNS AT 100
      KEV MEASURED BY MACKLIN ET AL./19,20/ AND CORNELIS ET AL.
      /21/

    MT = 16  (N,2N) CROSS SECTION
    MT = 17  (N,3N) CROSS SECTION
    MT = 22  (N,N'A) CROSS SECTION
    MT = 28  (N,N'P) CROSS SECTION
    MT =103  (N,P) CROSS SECTION
    MT =104  (N,D) CROSS SECTION
    MT =105  (N,T) CROSS SECTION
    MT =107  (N,ALPHA) CROSS SECTION
      THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
      PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

      THE KALBACH'S CONSTANT K (=  61.9) WAS ESTIMATED BY THE
      FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/22/ AND LEVEL
      DENSITY PARAMETERS.

      FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
      NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
        (N,P)           5.57  MB (SYSTEMATICS OF FORREST/23/)
        (N,ALPHA)       1.17  MB (SYSTEMATICS OF FORREST)

    MT = 251  MU-BAR
      CALCULATED WITH CASTHY.

  MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
    LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
    GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
    TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
    CALCULATED WITH CASTHY.  CONTRIBUTION OF DIRECT INELASTIC
    SCATTERING WAS CALCULATED WITH DWUCK-4.  FOR OTHER REACTIONS,
    ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

  MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
    ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
    PEGASUS FOR INELASTIC SCATTERING FROM OVERLAPPING LEVELS AND FOR
    OTHER NEUTRON EMITTING REACTIONS.

  TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                  DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
             ----------------------   ------------  ---------------
           V  = 50.01-0.5528E         R0 = 5.972    A0 = 0.56
           WS = 8.165                 RS = 6.594    AS = 0.44
           VSO= 5.261                 RSO= 5.97     ASO= 0.267
    THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

  TABLE 2  LEVEL DENSITY PARAMETERS

   NUCLIDE  SYST A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
   ---------------------------------------------------------------
   44-RU-106     1.870E+01 6.300E-01 1.097E+00 7.896E+00 2.530E+00
   44-RU-107     2.030E+01 6.000E-01 1.043E+01 6.637E+00 1.280E+00
   44-RU-108  *  1.826E+01 6.306E-01 1.050E+00 7.617E+00 2.420E+00
   44-RU-109  *  1.807E+01 6.282E-01 5.592E+00 6.353E+00 1.280E+00

   45-RH-107     1.963E+01 5.480E-01 3.151E+00 5.336E+00 1.250E+00
   45-RH-108  *  1.861E+01 6.306E-01 5.818E+01 5.341E+00 0.0
   45-RH-109     1.608E+01 6.270E-01 2.572E+00 5.371E+00 1.140E+00
   45-RH-110  *  1.824E+01 6.258E-01 4.505E+01 5.092E+00 0.0

   46-PD-108     1.790E+01 6.460E-01 8.844E-01 7.957E+00 2.600E+00
   46-PD-109     2.071E+01 6.030E-01 1.194E+01 6.925E+00 1.350E+00
   46-PD-110     1.880E+01 6.300E-01 1.215E+00 7.897E+00 2.490E+00
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46-PD-111     2.143E+01 5.610E-01 7.376E+00 6.267E+00 1.350E+00
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 SYST:  * = LDP'S WERE DETERMINED FROM SYSTEMATICS.
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SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 5.824 FOR PD-110 AND 5.0 FOR PD-111.

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MAT number = 4700

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 47-AG-  0 JAERI      EVAL-MAR87 LIU T.J.,T.NAKAGAWA,K.SHIBATA
                      DIST-SEP89 REV2-FEB94
HISTORY
87-03 NEW EVALUATION FOR JENDL-3/1/
87-07 COMPILED BY K.SHIBATA
94-02 JENDL-3.2 WAS MADE BY JNDC FPND W.G.

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)        RESOLVED RESONANCE PARAMETERS
      (3,2), (3,3), (3,4), (3,51-62), (3,64-71), (3,73-79)
                     CURVES OF INELASTIC SCATTERING CROSS SECTIONS
                     WERE SMOOTHED BY ADDING INTERPOLATED VALUES AT
                     SEVERAL ENERGY POINTS.
      (3,102)        ONLY Q-VALUE WAS MODIFIED.
     ***********************************************************


MF=1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY.

MF=2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
    THIS FILE WAS MADE OF AG-107 AND AG-109 DATA.
  RESOLVED RESONANCE PARAMETERS (BELOW 7.0095KEV)
       RESOLVED RESONANCE PARAMETERS (BELOW 7.0095 KEV) OF
    JENDL-3.1 ARE THE SAME AS THOSE OF JENDL-2, WHICH WERE MADE BY
    NAKAJIMA /2/ ON THE BASIS OF EXPERIMENTAL DATA BY MOXON AND
    RAE /3/, GARG ET AL./4/, ASGHAR ET AL./5/, PATTENDEN /6/,
    MURADJAN AND ADAMCHUK /7/, DE BARROS ET AL./8/, PATTENDEN AND
    JOLLY /9/, MACKLIN /10/ AND MIZUMOTO ET AL./11/. THERE ARE NO
    NEW EXPERIMENTAL DATA AVAILABLE SINCE THE JENDL-2 EVALUATION.
    TOTLA SPIN J AND ANGULAR MOMENTUM L OF SOME RESONANCES WERE
    ESTIMATED WITH A RANDOM NUMBER METHOD AND A METHODOF BOLLINGER
    AND THOMAS/12/, RESPECTIVELY.
      THE CAPTURE CROSS SECTION OF JENDL-3.1 BETWEEN 1.3 AND 2.6
    KEV IS TOO LOW COMPARED WITH INTERPOLATED VALUES FROM THE
    LOWER AND HIGHER ENERGY REGIONS.  TO COMPENSATE THE LOWER
    CAPTURE CROSS SECTION, HYPOTHETICAL P-WAVE RESONANCES WERE
    ADDED.  THE OTHER DATA ARE THE SAME AS JENDL-3.1, EXCEPT FOR
    NEUTRON WIDTH WHICH WAS MODIFIED SO AS TO REPRODUCE THE
    CAPTURE AREA MEASURED BY MACKLIN/10/.
  UNRESOLVED RESONANCE PARAMETERS (7.0095 - 100 KEV)
    THE PARAMETERS WERE DETERMINED WITH THE CODE ASREP /13/ TO
    REPRODUCE THE CAPTURE AND TOTAL CROSS SECTIONS, WHICH WERE
    BASED ON EXPERIMENTAL DATA /14,15/ AND ADJUSTED FOR
    CONSISTENCE BETWEEN THE DATA OF THE NATURAL ELEMENT AND ITS
    ISOTOPES.

   CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS):
                     2200 M/S               RES. INTEG.
      TOTAL          68.805                   -
      ELASTIC         5.180                   -
      CAPTURE        63.625                 762.9

MF=3  NEUTRON CROSS SECTIONS

 MT=1,102  TOTAL, CAPTURE
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.  NO BACKGROUND
  CROSS SECTIONS ARE ADOPTED.  ABOVE 100 KEV, CROSS SECTIONS WERE
  EVALUATED ON THE BASIS OF EXPERIMENTAL DATA AND THEORETICAL
  CALCULATIONS.  THE MAIN DATA WERE TAKEN FROM THE WORKS OF
  POENITZ AND WHALEN /14/, FOSTER AND  GLASGOW /16/ FOR TOTAL
  CROSS SECTOIN AND MIZUMOTO ET AL. /15/, POENITZ/17/ FOR CAPTURE
  CROSS SECTION.  THE DATA WERE FITTED WITH SPLINE FUNCTION /18/,
  AND WERE ADJUSTED FOR CONSISTENCE BETWEEN THE NATURAL ELEMENT
  AND ITS ISOTOPES.
 MT=2  ELASTIC
  ELASTIC = TOTAL - NONELASTIC
 MT=3  NONELASTIC
  SUM OF MT=4,16,17,22,28,102,103,107
 MT=4  TOTAL INELASTIC
  SUM OF MT=51-80,91
 MT=16,17,22,28,51-80,91,103,107  (N,2N),(N,3N),(N,NA),(N,NP),
 INELASTIC,(N,P),(N,A)
  THEY WERE MADE OF AG-107 AND AG-109 DATA.  FOR THESE TWO
  ISOTOPES, THE CROSS SECTIONS WERE CALCULATED WITH THE MULTISTEP
  HAUSER-FESHBACH CODE TNG /19, 20/.  AT FIRST, THE OPTICAL MODEL
  AND LEVEL DENSITY PARAMETERS WERE TAKEN FROM THE WORKS OF SMITH
  ET AL. /21/ AND IIJIMA ET AL. /22/, RESPECTIVELY AND THEN THEY
  WERE ADJUSTED TO REPRODUCE AVAILABLE EXPERIMENTAL DATA.
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FOR JENDL-3.2, INELASTIC SCATTERING CROSS SECTIONS AT THRESHOLD ENERGIES OF OTHER LEVELS WERE INSERTED BY INTERPOLATING THE CALUCULATED VALUES WITH AKIMA'S METHOD.

THE OPTICAL MODEL PARAMETERS ARE:

	DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
NEUTRON	V = 48.25-0.3E	R0 = 1.249	A0 = 0.603
	WS = 8.501-0.15E	RS = 1.270	AS = 0.575
	VSO= 6.0	RSO= 1.249	ASO= 0.603
PROTON	V = 66.061-0.550E	R0 = 1.150	A0 = 0.650
	WS = 12.50-0.10E	RS = 1.250	AS = 0.470
		RC = 1.150	
ALPHA	V = 193.0-0.15E	R0 = 1.370	A0 = 0.560
	WS = 21.00+0.25E	RS = 1.370	AS = 0.560
		RC = 1.370	

THE LEVEL DENSITY PARAMETERS ARE:

	ECUT(MEV)	EJO(MEV)	T(MEV)	A(1/MEV)	C(MEV)	CSPIN	EPAIR
RH-103	0.990	5.409	0.655	15.50	3.884	49.725	0.94
RH-104	0.230	4.351	0.650	15.43	17.72	49.820	0.00
RH-105	0.770	5.700	0.630	16.80	4.000	54.591	1.24
RH-106	0.150	3.869	0.575	17.50	17.18	57.230	0.00
PD-106	2.380	8.004	0.666	17.17	0.920	56.147	2.59
PD-107	0.700	7.693	0.769	14.98	6.956	49.293	1.35
PD-108	1.900	7.957	0.646	17.90	0.884	59.268	2.60
PD-109	0.360	7.380	0.687	17.50	9.479	58.301	1.35
AG-105	1.230	5.830	0.609	18.57	2.750	60.343	0.94
AG-106	0.400	3.549	0.563	17.16	12.92	56.110	0.00
AG-107	1.420	5.918	0.693	14.55	2.412	47.878	1.24
AG-108	0.270	3.014	0.576	15.04	6.004	49.799	0.00
AG-109	1.180	6.112	0.705	14.50	2.666	48.306	1.25
AG-110	0.320	3.150	0.454	17.01	2.513	57.015	0.00

THE LEVEL SCHEME IS GIVEN AS FOLLOWS:

AG-107:

NO.	ENERGY(MEV)	SPIN-PARITY
GR.	0.0	1/2 -
1	0.0930	7/2 +
2	0.1260	(9/2)+
3	0.3250	3/2 -
4	0.4230	5/2 -
5	0.7730	(11/2)+
6	0.7870	3/2 -
7	0.9220	5/2 +
8	0.9500	5/2 -
9	0.9730	(7/2)-
10	0.9910	(13/2)+
11	1.0610	(1/2 -)
12	1.1420	1/2 +
13	1.1470	7/2 -
14	1.2230	5/2 +
15	1.2590	(3/2)+
16	1.3260	(3/2)+

AG-109:

NO.	ENERGY(MEV)	SPIN-PARITY
GR.	0.0	1/2 -
1	0.0880	7/2 +
2	0.1330	9/2 +
3	0.3110	3/2 -
4	0.4150	5/2 -
5	0.7020	3/2 -
6	0.7070	3/2 +
7	0.7240	(3/2)+
8	0.7360	5/2 +
9	0.8630	5/2 -
10	0.8700	(5/2)+
11	0.9110	7/2 +
12	0.9120	7/2 -
13	1.0910	9/2 -
14	1.0990	(5/2 +)

MT=251
CALCULATED FROM MF=4,MT=2.

MF=4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=2
CALCULATED WITH THE CASTHY CODE /23/.
MT=51-80
CALCULATED WITH TNG.

MT=16,17,22,28,91
 ASSUMED TO BE ISOTROPIC IN THE LABORATORY SYSTEM.

MF=5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=16,17,22,28,91
  CALCULATED WITH TNG.

MF=12,14,15 GAMMA-PRODUCTION DATA
 MT=4,16,17,22,28,102,103,107
  CALCULATED WITH TNG.

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MAT number = 4725
 47-AG-107 JAERI      EVAL-MAR87 LIU T.J.,T.NAKAGAWA.,K.SHIBATA
                      DIST-SEP89 REV2-FEB94
HISTORY
87-03 NEW EVALUATION FOR JENDL-3/1/
87-07 COMPILED BY K.SHIBATA
94-02 JENDL-3.2 WAS MADE BY JNDC FPND W.G.

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)          RESOLVED RESONANCE PARAMETERS
      (3,2), (3,3), (3,4), (3,51-54), (3,56-59), (3,61-66)
                       CURVES OF INELASTIC SCATTERING CROSS SECTIONS
                       WERE SMOOTHED BY ADDING INTERPOLATED VALUES AT
                       SEVERAL ENERGY POINTS.
     ***********************************************************


MF=1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF=2  RESONANCE PARAMETERS
  MT=151
  RESOLVED RESONANCE PARAMETERS (BELOW 7.0095 KEV)
       RESOLVED RESONANCE PARAMETERS (BELOW 7.0095KEV) FOR
    JENDL-3.1 ARE THE SAME AS THOSE OF JENDL-2, WHICH WERE MADE BY
    NAKAJIMA /2/ ON THE BASIS OF EXPERIMENTAL DATA BY MOXON AND
    RAE /3/, GARG ET AL./4/, ASGHAR ET AL./5/, MURADJAN AND
    ADAMCHUK /6/, DE BARROS ET AL./7/, PATTENDEN AND JOLLY /8/,
    MACKLIN /9/ AND MIZUMOTO ET AL./10/.  THERE WERE NO NEW
    EXPERIMENTAL DATA AVAILABLE SINCE JENDL-2 EVALUATION.  ONLY
    TOTAL SPIN J AND ANGULAR MOMENTUM L OF SOME RESONANCES WAS
    ESTIMATED WITH A RANDOM NUMBER METHOD AND A METHOD OF
    BOLLINGER AND THOMAS/11/, RESPECTIVELY.
      THE CAPTURE CROSS SECTION OF JENDL-3.1 BETWEEN 1.3 AND 2.6
    KEV IS TOO LOW COMPARED WITH INTERPOLATED VALUES FROM THE
    LOWER AND HIGHER ENERGY REGIONS.  TO COMPENSATE THE LOWER
    CAPTURE CROSS SECTION, P-WAVE RESONANCES WITH A CAPTURE AREA
    OF 0.04 EV WERE ADDED EVERY 40 EV BETWEEN 1.28 AND 2.04 KEV,
    AND EVERY 15 EV BETWEEN 2.04 AND 2.64 KEV.  THE OTHER DATA ARE
    THE SAME AS JENDL-3.1, EXCEPT FOR NEUTRON WIDTH WHICH WAS
    MODIFIED SO AS TO REPRODUCE THE CAPTURE AREA MEASURED BY
    MACKLIN/9/.

  UNRESOLVED RESONANCE PARAMETERS (7.0095 - 100 KEV)
    THE PARAMETERS WERE DETERMINED WITH THE ASREP CODE /12/ TO
    REPRODUCE THE CAPTURE AND TOTAL CROSS SECTIONS, WHICH WERE
    BASED ON EXPERIMENTAL DATA /13, 14/ AND ADJUSTED FOR
    CONSISTENCE BETWEEN THE DATA OF THE NATURAL ELEMENT AND ITS
    ISOTOPES. THE TYPICAL PARAMETERS ARE :

      S0 = (0.344-0.516)E-4,  S1 = (3.5-4.5)E-4,  S2= 0.53E-4,
      D-OBS= (18.5-22.8)EV,   R=6.54FM

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS):
                     2200 M/S                 RES. INTEG.
      TOTAL          46.310                       -
      ELASTIC         7.687                       -
      CAPTURE        38.623                     104

MF=3  NEUTRON CROSS SECTIONS

 MT=1,102  TOTAL, CAPTURE
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.  NO BACKGROUND
  CROSS SECTIONS ARE ADOPTED.  ABOVE 100 KEV, CROSS SECTIONS WERE
  EVALUATED ON THE BASIS OF EXPERIMENTAL DATA AND THEORETICAL
  CALCULATIONS.  THE MAIN DATA WERE TAKEN FROM THE WORKS OF
  DUKEREVICH ET AL. /15/, SMITH ET AL. /16/ FOR TOTAL CROSS
  SECTOIN AND MIZUMOTO ET AL. /12/, MACKLIN ET AL. /9/ FOR CAPTURE
  CROSS SECTION. THE DATA WERE FITTED WITH SPLINE FUNCTION
  /17/,AND WERE ADJUSTED FOR CONSISTENCE BETWEEN THE NATURAL
  ELEMENT AND ITS ISOTOPES.
 MT=2  ELASTIC
  ELASTIC = TOTAL - NONELASTIC
 MT=3  NONELASTIC
  SUM OF MT=4,16,17,22,28,102,103,107
 MT=4  TOTAL INELASTIC
  SUM OF MT=51-66,91
 MT=16,17,22,28,51-66,91,103,107  (N,2N),(N,3N),(N,NA),(N,NP),
 INELASTIC,(N,P),(N,A)
  FOR THESE REACTIONS THE CROSS SECTIONS WERE CALCULATED WITH THE
  MULTI-STEP HAUSER-FESHBACH CODE TNG /18, 19/.  AT FIRST, THE
  OPTICAL MODEL AND LEVEL DENSITY PARAMETERS WERE TAKEN FROM THE
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WORKS OF SMITH ET AL./20/ AND IIJIMA ET AL./21/, RESPECTIVELY AND THEN THEY WERE ADJUSTED TO REPRODUCE THE AVAILABLE EXPERIMENTAL DATA.

FOR JENDL-3.2, INELASTIC SCATTERING CROSS SECTIONS AT THRESHOLD ENERGIES OF OTHER LEVELS WERE INSERTED BY INTERPOLATING THE CALUCULATED VALUES WITH AKIMA'S METHOD.

THE OPTICAL MODEL PARAMETERS ARE:

	DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
NEUTRON	V = 48.25-0.3E	R0 = 1.249	A0 = 0.603
	WS = 8.501-0.15E	RS = 1.270	AS = 0.575
	VSO= 6.000	RSO= 1.249	ASO= 0.603
PROTON	V = 66.061-0.550E	R0 = 1.150	A0 = 0.650
	WS = 12.50-0.10E	RS = 1.250	AS = 0.470
		RC = 1.150	
ALPHA	V = 193.0-0.15E	R0 = 1.370	A0 = 0.560
	WS = 21.00+0.25E	RS = 1.370	AS = 0.560
		RC = 1.370	

THE LEVEL DENSITY PARAMETERS ARE:

	ECUT(MEV)	EJO(MEV)	T(MEV)	A(1/MEV)	C(MEV)	CSPIN	EPAIR
RH-103	0.990	5.409	0.655	15.50	3.884	49.725	0.94
RH-104	0.230	4.351	0.650	15.43	17.72	49.820	0.00
PD-106	2.380	8.004	0.666	17.17	0.920	56.147	2.59
PD-107	0.700	7.693	0.769	14.98	6.956	49.293	1.35
AG-105	1.230	5.830	0.609	18.57	2.750	60.343	0.94
AG-106	0.400	3.549	0.563	17.16	12.92	56.110	0.00
AG-107	1.420	5.918	0.693	14.55	2.412	47.878	1.24
AG-108	0.270	3.014	0.576	15.04	6.004	49.799	0.00

THE LEVEL SCHEME IS GIVEN AS FOLLOWS:

NO.	ENERGY(MEV)	SPIN-PARITY
GR.	0.0	1/2 -
1	0.0930	7/2 +
2	0.1260	(9/2)+
3	0.3250	3/2 -
4	0.4230	5/2 -
5	0.7730	(11/2)+
6	0.7870	3/2 -
7	0.9220	5/2 +
8	0.9500	5/2 -
9	0.9730	(7/2)-
10	0.9910	(13/2)+
11	1.0610	(1/2 -)
12	1.1420	1/2 +
13	1.1470	7/2 -
14	1.2230	5/2 +
15	1.2590	(3/2)+
16	1.3260	(3/2)+

CONTINUUM LEVELS WERE ASSUMED ABOVE 1.42 MEV.

MT=251
CALCULATED FROM MF=4,MT=2.

MF=4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=2
CALCULATED WITH THE CASTHY CODE /22/.
MT=51-66
CALCULATED WITH THE TNG CODE.
MT=16,17,22,28,91
ASSUMED TO BE ISOTROPIC IN THE LABORATORY SYSTEM.

MF=5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=16,17,22,28,91
CALCULATED WITH TNG.

MF=12,14,15 GAMMA-PRODUCTION DATA
MT=4,16,17,22,28,102,103,107
CALCULATED WITH TNG.

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MAT number = 4731
 47-AG-109 JAERI      EVAL-MAR87 LIU T.J.,T.NAKAGAWA,K.SHIBATA
                      DIST-SEP89 REV2-FEB94
HISTORY
87-03  NEW EVALUATION FOR JENDL-3/1/
87-07  COMPILED BY K.SHIBATA
94-02 JENDL-3.2 WAS MADE BY JNDC FPND W.G.

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)        RESOLVED RESONANCE PARAMETERS
      (3,2), (3,3), (3,4), (3,51-64)
                     CURVES OF INELASTIC SCATTERING CROSS SECTIONS
                     WERE SMOOTHED BY ADDING INTERPOLATED VALUES AT
                     SEVERAL ENERGY POINTS.
      (3,102)        ONLY Q-VALUE WAS MODIFIED.
      (3,107)        CROSS SECTION OF 0.0 INSERTED AT 1 MEV.
     ***********************************************************


MF=1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY.

MF=2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE PARAMETERS (BELOW 7.0095KEV)
       RESOLVED RESONANCE PARAMETERS (BELOW 7.0095KEV) OF
    JENDL-3.1 ARE THE SAME AS THOSE OF JENDL-2, WHICH WERE MADE BY
    NAKAJIMA /2/ ON THE BASIS OF EXPERIMENTAL DATA BY MOXON AND
    RAE/3/, GARG ET AL./4/, ASGHAR ET AL./5/, PATTENDEN/6/,
    MURADJAN AND ADAMCHUK /7/, DE BARROS ET AL./8/, PATTENDEN AND
    JOLLY/9/, MACKLIN/10/ AND MIZUMOTO ET AL./11/. THERE WAS NO
    NEW EXPERIMENTAL DATA AVAILABLE SINCE THE JENDL-2 EVALUATION.
    TOTAL SPIN J AND ANGULAR MOMENTUM L OF SOME RESONANCES WAS
    ESTIMATED WITH A RANDOM NUMBER METHOD AND A METHOD OF
    BOLLINGER AND THOMAS/12/, RESPECTIVELY.
       THE CAPTURE CROSS SECTION OF JENDL-3.1 IS TOO LOW BETWEEN
    1.3 KEV AND 2.6 KEV COMPARED WITH INTERPOLATED VALUES FROM THE
    HIGHER AND LOWER ENERGY REGIONS.  TO COMPENSATE THE LOW
    CAPTURE CROSS SECTION, P-WAVE RESONANCES WITH CAPTURE AREA OF
    0.020 EV WERE ADDED EVERY 20 EV BETWEEN 1.25 AND 1.59 KEV, AND
    EVERY 40 EV BETWEEN 1.59 AND 2.59 KEV.  THE OTHER DATA ARE THE
    SAME AS JENDL-3.1, EXCEPT FOR NEUTRON WIDTH WHICH WAS MODIFIED
    SO AS TO REPRODUCE THE CAPTURE AREA DATA MEASURED BY MACKLIN.
  UNRESOLVED RESONANCE PARAMETERS (7.0095 - 100 KEV)
    THE PARAMETERS WERE DETERMINED WITH CODE ASREP /13/ TO
    REPRODUCE THE CAPTURE AND TOTAL CROSS SECTIONS, WHICH WERE
    BASED ON EXPERIMENTAL DATA /14, 15/ AND ADJUSTED FOR
    CONSISTENCE BETWEEN THE DATA OF THE NATURAL ELEMENT AND ITS
    ISOTOPES.  THE TYPICAL PARAMETERS ARE :

      S0 = (0.315-0.540)E-4,  S1 = (3.61-4.34)E-4,  S2= 0.53E-4,
      D-OBS= (17.5-20.2)EV,   R=6.18FM

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS):
                     2200 M/S               RES. INTEG.
      TOTAL          93.018                     -
      ELASTIC         2.483                     -
      CAPTURE        90.536                   1470

MF=3  NEUTRON CROSS SECTIONS

 MT=1,102  TOTAL, CAPTURE
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.  NO BACKGROUND
  CROSS SECTIONS ARE ADOPTED.  ABOVE 100 KEV, CROSS SECTIONS WERE
  EVALUATED ON THE BASIS OF EXPERIMENTAL DATA AND THEORETICAL
  CALCULATIONS.  THE MAIN DATA WERE TAKEN FROM THE WORKS OF
  MIZUMOTO ET AL. /15/, MACKLIN /10/ FOR CAPTURE CROSS SECTION.
  THE DATA WERE FITTED WITH SPLINE FUNCTION /16/,AND WERE ADJUSTED
  FOR CONSISTENCE BETWEEN THE NATURAL ELEMENT AND ITS ISOTOPES.
 MT=2  ELASTIC
  ELASTIC = TOTAL - NONELASTIC
 MT=3  NONELASTIC
  SUM OF MT=4,16,17,22,28,102,103,107
 MT=4  TOTAL INELASTIC
  SUM OF MT=51-64,91
 MT=16,17,22,28,51-64,91,103,107  (N,2N),(N,3N),(N,NA),(N,NP),
 INELASTIC,(N,P),(N,A)
  FOR THESE REACTIONS THE CROSS SECTIONS WERE CALCULATED WITH THE
  MULTISTEP HAUSER-FESHBACH CODE TNG /17,18/.  AT FIRST, THE
  OPTICAL MODEL AND LEVEL DENSITY PARAMETERS WERE TAKEN FROM THE
  WORKS OF SMITH ET AL./19/ AND IIJIMA ET AL./20/, RESPECTIVELY
  AND THEN THEY WERE ADJUSTED TO REPRODUCE THE AVAILABLE
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EXPERIMENTAL DATA.

FOR JENDL-3.2, INELASTIC SCATTERING CROSS SECTIONS AT THRESHOLD ENERGIES OF OTHER LEVELS WERE INSERTED BY INTERPOLATING THE CALUCULATED VALUES WITH AKIMA'S METHOD.

THE OPTICAL MODEL PARAMETERS ARE:

	DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
NEUTRON	V = 48.25-0.3E	R0 = 1.249	A0 = 0.603
	WS = 8.501-0.15E	RS = 1.270	AS = 0.575
	VSO= 6.0	RSO= 1.249	ASO= 0.603
PROTON	V = 66.061-0.550E	R0 = 1.150	A0 = 0.650
	WS = 12.50-0.10E	RS = 1.250	AS = 0.470
		RC = 1.150	
ALPHA	V = 193.0-0.15E	R0 = 1.370	A0 = 0.560
	WS = 21.00+0.25E	RS = 1.370	AS = 0.560
		RC = 1.370	

THE LEVEL DENSITY PARAMETERS ARE:

	ECUT(MEV)	EJO(MEV)	T(MEV)	A(1/MEV)	C(MEV)	CSPIN	EPAIR
RH-105	0.770	5.700	0.630	16.80	4.000	54.591	1.24
RH-106	0.150	3.869	0.575	17.50	17.18	57.230	0.00
PD-108	1.900	7.957	0.646	17.90	0.884	59.268	2.60
PD-109	0.360	7.380	0.687	17.50	9.479	58.301	1.35
AG-107	1.420	5.918	0.693	14.55	2.412	47.878	1.24
AG-108	0.270	3.014	0.576	15.04	6.004	49.799	0.00
AG-109	1.180	6.112	0.705	14.50	2.666	48.306	1.25
AG-110	0.320	3.150	0.454	17.01	2.513	57.015	0.00

THE LEVEL SCHEME USED IS GIVEN AS FOLLOWS:

NO.	ENERGY(MEV)	SPIN-PARITY
GR.	0.0	1/2 -
1	0.0880	7/2 +
2	0.1330	9/2 +
3	0.3110	3/2 -
4	0.4150	5/2 -
5	0.7020	3/2 -
6	0.7070	3/2 +
7	0.7240	(3/2)+
8	0.7360	5/2 +
9	0.8630	5/2 -
10	0.8700	(5/2)+
11	0.9110	7/2 +
12	0.9120	7/2 -
13	1.0910	9/2 -
14	1.0990	(5/2 +)

CONTINUUM LEVELS WERE ASSUMED ABOVE 1.18 MEV.

MT=251
CALCULATED FROM MF=4,MT=2.

MF=4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=2
CALCULATED WITH THE CASTHY CODE /21/.
MT=51-64
CALCULATED WITH TNG.
MT=16,17,22,28,91
ASSUMED TO BE ISOTROPIC IN THE LABORATORY SYSTEM.

MF=5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=16,17,22,28,91
CALCULATED WITH TNG.

MF=12,14,15 GAMMA-PRODUCTION DATA
MT=4,16,17,22,28,102,103,107
CALCULATED WITH TNG.

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MAT number = 4735

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 47-AG-110MJNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 0.125 KEV
    MOST PARAMETERS WERE BASED ON THE EXPERIMENTS BY ANUFRIEV ET
    AL./2/  AVERAGE RADIATION WIDTH OF 148 MEV/2/ WAS ADOPTED.
    TOTAL SPIN J WAS TENTATIVELY ESTIMATED WITH A RANDOM NUMBER
    METHOD.  NEUTRON ORBITAL ANGULAR MOMENTUM L WAS ESTIMATED WITH
    A METHOD OF BOLLINGER AND THOMAS /3/.  A NEGATIVE RESONANCE AT
    -2 EV WAS ADDED SO AS TO REPRODUCE THE THERMAL CAPTURE CROSS
    SECTIONS GIVEN BY MUGHABGHAB ET AL./4/

  UNRESOLVED RESONANCE REGION : 0.125 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/5/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.  THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS
    OF MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.810E-4, S1 = 2.970E-4, S2 = 0.930E-4, SG = 1720.E-4,
    GG = 0.148 EV, R  = 6.032 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL          88.47                     -
      ELASTIC         6.468                    -
      CAPTURE        82.00                   94.1

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/6/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE THE CD-NATURAL TOTAL CROSS SECTIONS
  MEASURED BY FOSTER AND GLASGOW/7/, POENITZ AND WHALEN/8/ AND SO
  ON, AND APPLIED TO AG-110M.  THE OMP'S FOR CHARGED PARTICLES ARE
  AS FOLLOWS:
     PROTON   = PEREY/9/
     ALPHA    = HUIZENGA AND IGO/10/
     DEUTERON = LOHR AND HAEBERLI/11/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/12/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/13/ WERE EVALUATED BY IIJIMA ET AL./14/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /15/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/16/ AND NUCLEAR DATA
    SHEETS/17/.

           NO.       ENERGY(MEV)    SPIN-PARITY
           GR.        0.0             6  +
            1        -0.1176          1  +
            2        -0.1066          2  -
            3         0.0011          3  +
            4         0.0736          3  +
            5         0.0740          2  +
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6	0.0811	2	+
7	0.1193	1	-
8	0.1194	0	-
9	0.1496	1	+
10	0.1514	1	-
11	0.1539	2	+
12	0.1841	2	+
13	0.1869	1	+
14	0.2194	0	-
15	0.2213	0	-
16	0.2430	1	+
17	0.2604	1	-
18	0.2636	1	+
19	0.2944	2	+
20	0.3071	1	-
21	0.3148	2	+
22	0.3389	2	+
23	0.3493	2	+
24	0.3513	1	+
25	0.3536	1	-
26	0.3664	0	-
27	0.3682	2	+
28	0.3793	1	-
29	0.4081	1	+

LEVELS ABOVE 0.41 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/18/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (1.88E-01) WAS DETERMINED FROM THE SYSTEMATICS OF RADIATION WIDTH (0.13 EV) AND THE AVERAGE S-WAVE RESONANCE LEVEL SPACING (0.693 EV) CALCULATED FROM THE LEVEL DENSITY PARAMETERS.

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT = 32 (N,N'D) CROSS SECTION
MT = 33 (N,N'T) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =106 (N,HE3) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 81.5) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/19/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
(N,P) 13.10 MB (SYSTEMATICS OF FORREST/20/)
(N,ALPHA) 2.84 MB (SYSTEMATICS OF FORREST)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING FROM OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 50.01-0.5528E	R0 = 5.972	A0 = 0.56
WS = 8.165	RS = 6.594	AS = 0.44
VSO= 5.261	RSO= 5.97	ASO= 0.267

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
45-RH-106		1.700E+01	5.300E-01	8.449E+00	2.973E+00	0.0
45-RH-107		1.963E+01	5.480E-01	3.151E+00	5.336E+00	1.250E+00
45-RH-108	*	1.861E+01	6.306E-01	5.818E+01	5.341E+00	0.0
45-RH-109		1.608E+01	6.270E-01	2.572E+00	5.371E+00	1.140E+00
46-PD-107		1.916E+01	6.110E-01	6.467E+00	6.507E+00	1.350E+00
46-PD-108		1.790E+01	6.460E-01	8.844E-01	7.957E+00	2.600E+00
46-PD-109		2.071E+01	6.030E-01	1.194E+01	6.925E+00	1.350E+00
46-PD-110		1.880E+01	6.300E-01	1.215E+00	7.897E+00	2.490E+00
47-AG-108		1.671E+01	5.760E-01	1.221E+01	3.609E+00	0.0
47-AG-109		1.650E+01	6.300E-01	2.761E+00	5.709E+00	1.250E+00
47-AG-110		1.791E+01	5.900E-01	2.444E+01	4.282E+00	0.0
47-AG-111		1.955E+01	5.810E-01	6.505E+00	5.835E+00	1.140E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 2.711 FOR AG-110 AND 5.0 FOR AG-111.

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MAT number = 4800
 48-CD-  0 JNDC       EVAL-MAR89 JNDC FP ND W.G., N.YAMAMURO
                      DIST-OCT89 REV2-DEC93
HISTORY
89-03 EVALUATION OF CD ISOTOPES FOR JENDL-3 WAS MADE BY JNDC FP
      NUCLEAR DATA W.G./1/, AND DATA FOR NATURAL CD WERE
      CONSTRUCTED FROM THEM BY T.NAKAGAWA(JAERI).
89-03 PHOTON PRODUCTION DATA WERE CALCULATED BY N.YAMAMURO (DATA
      ENGINEERING)
93-12 JENDL-3.2
       GAMMA-RAY PRODUCTION DATA : BY S. IGARASI (NDEAC)
       RESONANCE PARAMETERS: BY  Y. NAKAJIMA, T.NAKAGAWA(JAERI)
      COMPILED BY T.NAKAGAWA (NDI/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151):     SCATTERING RADIUS OF EACH ISOTOPE
                   RESOLVED RESONANCE PARAMETERS OF CD-110, -111
                   UPPER BOUNDARY ENERGY OF CD-111
                   UNRESOLVED RESONANCE PARAMETERS
      (3,2), (3,3), (3,4), (3,51), (3,53-60), (3,63-64),
      (3,66), (3,78-81), (3,83), (3,91), (3,102), (3,103),
      (3,106), (3,111):
                   EFFECTS OF MODIFICATION OF CD-111 DATA, AND
                   MODIFICATIONS MADE TO ISOTOPE DATA AFTER
                   COMPILATION OF NATURAL CD DATA FOR JENDL-3.1.
      (5,16-91):   SUMMED UP INTO A SINGLE TABLE OF DISTRIBUTIONS.
      (12,102), (15,102):  BELOW 100 KEV.
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MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA)
      EVALUATION WAS MADE ON THE BASIS OF THE FOLLOWING DATA FOR
      EACH ISOTOPE.
    CD-106 : BELOW 0.7 KEV
             MUGHABGHAB ET AL./2/
        ASSUMED CAPTURE WIDTH = 0.153 EV
    CD-108 : BELOW 0.38 KEV
             ANUFRIEV ET AL./3/
        ASSUMED CAPTURE WIDTH = 0.110 EV
    CD-110 : BELOW 7.0 KEV
             LIOU ET AL./4/, MUSGROVE ET AL./5/, ALFIMENKOV
             ET AL./6/.
        ASSUMED CAPTURE WIDTH = 0.102 EV
    CD-111 : BELOW 1.8 KEV
             LIOU ET AL./4/, WASSON AND ALLEN/7/
        ASSUMED CAPTURE WIDTH = 0.102 EV
    CD-112 : BELOW 7.0 KEV
             LIOU ET AL./4/, MUSGROVE ET AL./5/.
        ASSUMED CAPTURE WIDTH =  0.1 EV/4/ BELOW 2.0 KEV, AND
                          0.077 EV ABOVE 2.0 KEV FOR S-WAVE RES.
                          0.096 EV/5/ FOR P-WAVE RES.
    CD-113 : BELOW 2.0 KEV
             LIOU ET AL./4/.
        ASSUMED CAPTURE WIDTH = 0.101 EV/4/
    CD-114 : BELOW 8.0 KEV
             LIOU ET AL./1/, MUSGROVE ET AL./5/.
        ASSUMED CAPTURE WIDTH = 0.11 EV /4/ BELOW 2.0 KEV, AND
                          0.053 EV ABOVE 2.0 KEV FOR S-WAVE RES.
                          0.082 EV/5/ FOR P-WAVE RES.
    CD-116 : BELOW 9.0 KEV
             LIOU ET AL./4/, MUSGROVE ET AL./5/.
        ASSUMED CAPTURE WIDTH = 0.047 EV FOR S-WAVE RES. AND
                          0.085 EV FOR P-WAVE RES/5/.
    IN ORDER TO REPRODUCE WELL MEASURED TOTAL CROSS SECTIONS,
    EFFECTIVE SCATTERING RADIUS OF 6.2 FM WAS ASSUMED FOR THE ALL
    ISOTOPES.
  UNRESOLVED RESONANCE REGION : UP TO 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS FOR L=0 AND 1 WERE TAKEN FROM
    MUGHABGHAB ET AL./2/, AND THOSE FOR L=2 WERE CALCULATED WITH
    OPTICAL MODEL CODE CASTHY/8/.  AVERAGE RADIATIVE CAPTURE
    WIDTHS WERE ALSO TAKEN FROM REF./2/.  THE OBSERVED LEVEL
    SPACINGS WERE DETERMINED TO REPRODUCE THE CAPTURE CROSS
    SECTIONS CALCULATED WITH CASTHY FOR CD-110, CD-112, CD-113,
    CD-114 AND CD-116, AND THE CAPTURE CROSS SECTIONS DETERMINED
    FROM EXPERIMENTAL DATA FOR THE OTHER ISOTOPES.  THE EFFECTIVE
    SCATTERING RADIUS WAS OBTAINED FROM FITTING TO THE CALCULATED
    TOTAL CROSS SECTION AT 100 KEV.  FINALLY, BACKGROUND CROSS
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SECTION WAS GIVEN TO THE CAPTURE TO REPRODUCE THE EXPERIMENTAL DATA/9,10/

UNRESOLVED RESONANCE PARAMETERS (AT 70 KEV)

NUCLIDE	S0	S1	S2	GG(S,D) (EV)	GG(P) (EV)	D-OBS (EV)	R (FM)
CD-106	1.00E-4	5.00E-4	0.97E-4	0.155	0.175	131	4.70
CD-108	1.20E-4	4.80E-4	0.95E-4	0.105	0.125	147	4.59
CD-110	0.44E-4	3.00E-4	0.93E-4	0.071	0.080	155	6.25
CD-111	0.45E-4	3.90E-4	0.53E-4	0.160	0.160	15.8	5.76
CD-112	0.50E-4	4.40E-4	0.91E-4	0.077	0.090	212	5.44
CD-113	0.31E-4	2.20E-4	0.90E-4	0.160	0.160	27.4	6.74
CD-114	0.64E-4	3.50E-4	0.89E-4	0.053	0.070	250	5.80
CD-116	0.16E-4	2.80E-4	0.87E-4	0.047	0.070	432	6.49

CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)

	2200 M/S	RES. INTEG.
TOTAL	2535.9	-
ELASTIC	7.649	-
CAPTURE	2528.2	67.9

MF = 3 NEUTRON CROSS SECTIONS
BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN. ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS PERFORMED WITH CASTHY/8/, BY TAKING ACCOUNT OF COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED WITH PEGASUS/11/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL. THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE DETERMINED TO REPRODUCE THE CD-111 TOTAL CROSS SECTION. THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:

PROTON = PEREY/12/
ALPHA = HUIZENGA AND IGO/13/
DEUTERON = LOHR AND HAEBERLI/14/
HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/15/

PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GIRBERT AND CAMERON/16/ WERE EVALUATED BY IIJIMA ET AL./17/. MORE EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE PRESENT WORK. TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED IN THE PRESENT CALCULATION. ENERGY DEPENDENCE OF SPIN CUT-OFF PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR /18/.

MT = 1 TOTAL
SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED. IN THE ENERGY REGION FROM 100 KEV TO 2.5 MEV, CROSS SECTION WAS DETERMINED FROM THE DATA MEASURED BY WHALEN ET AL./19/, GREEN ET AL./20/ AND POENITZ AND WHALEN/21/.

MT = 2 ELASTIC SCATTERING
CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

MT = 3 NON-ELASTIC SCATTERING
SUM OF PARTIAL CROSS SECTIONS EXCEPT MT=2.

MT = 4, 51 - 91 INELASTIC SCATTERING
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS ADOPTED. THE LEVEL SCHEMES WERE TAKEN FROM REF./22/ FOR CD-106 AND 108, REF./23/ FOR CD-110, 111, 112 1ND 113, AND REF./24/ FOR CD-114 AND 116. THE DIRECT CROSS SECTION WAS CALCULATED WITH DWUCK-4/25/ TO 2+ AND 3- LEVELS OF EVEN-MASS ISOTOPES WHICH ARE MARKED WITH '*' IN THE FOLLOWING TABLE. THE CROSS SECTIONS WERE GROUPED AS FOLLOWS:

MT	-Q(MEV)	106	108	110	111	112	113	114	116
51	-0.2454	-	-	-	51	-	51	-	-
52	-0.2986	-	-	-	-	-	52,53	-	-
53	-0.3419	-	-	-	52,53	-	-	-	-
54	-0.4166	-	-	-	54	-	54,55	-	-
55	-0.5131	-	-	-	-	-	56	-	51*
56	-0.5583	-	-	-	-	-	57	51*	-
57	-0.6174	51*	51*	-	55	51*	-	-	-
58	-0.6577	-	-	51*	56	-	58,59	-	-
59	-0.754	-	-	-	57	-	-	-	-
60	-0.8553	-	-	-	58	-	60	-	-
61	-0.8836	-	-	-	-	-	61	-	-
62	-0.9884	-	-	-	-	-	62,63	-	-
63	-1.02	-	-	-	59	-	-	-	-
64	-1.1261	-	-	-	60	-	64	-	-
65	-1.1342	-	-	-	-	-	-	52	-
66	-1.19	-	-	-	61	-	65	-	-
67	-1.2093	-	-	-	-	-	-	53	52,53
68	-1.223	-	-	-	-	52	-	-	-

69	-1.283	-	-	-	-	-	-	54	54
70	-1.3052	-	-	-	-	53	-	55	-
71	-1.361	-	-	-	-	-	-	-	55
72	-1.3639	-	-	-	-	54	-	56	-
73	-1.4317	-	-	-	-	55,56	-	-	-
74	-1.4732	52	52	52,53	-	-	-	-	-
75	-1.5424	53	53,54	54	-	-	-	-	-
76	-1.7318	-	-	55	-	-	-	57,58	-
77	-1.7833	-	-	56,57	-	-	-	-	-
78	-1.971	-	55,56	-	-	57	-	-	-
79	-1.971	-	-	58	-	58*,59	-	-	-
80	-2.0788	54	-	59*,60	-	-	-	-	-
81	-2.1627	-	57,58*	61	-	-	-	-	-
82	-2.22	55-57	59	62	-	-	-	-	-
83	-2.355	58*	60	63	-	-	-	-	-
84	-2.4641	59-61	61	64,65	-	-	-	-	-
85	-2.538	-	62	66	-	-	-	-	-
86	-2.5612	-	63-69	67	-	-	-	-	-
87	-2.7864	-	70	68	-	-	-	-	-
88	-2.868	-	-	69,70	-	-	-	-	-
89	-2.9266	-	71-77	71	-	-	-	-	-
91	-1.1948	91	91	91	91	91	91	91	91

MT = 102 CAPTURE

SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY/8/ WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/26/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV. THE GAMMA-RAY STRENGTH FUNCTIONS WERE ADJUSTED TO REPRODUCE THE FOLLOWING CAPTURE CROSS SECTIONS.

NUCLIDE	CROSS SECTION(B)	STRENGTH FUNCTION
CD-106	0.34 AT 70 KEV	14.2E-4
CD-108	0.23 AT 70 KEV	8.63E-4
CD-110	0.245 AT 30 KEV	4.65E-4
CD-111	0.664 AT 90 KEV	103.2E-4
CD-112	0.22 AT 30 KEV	4.04E-4
CD-113	0.72 AT 30 KEV	46.5E-4
CD-114	0.15 AT 30 KEV	2.50E-4
CD-116	0.09 AT 30 KEV	1.35E-4

AT THE ENERGIES BELOW 10 MEV, THE CROSS SECTION WAS MODIFIED TO WELL REPRODUCE THE DATA MEASURED BY KOMPE/9/ AND POENITZ /10/, BY ADOPTING BACKGROUND DATA IN THE UNRESOLVED RESONANCE REGION AND MULTIPLING AN ENERGY DEPENDENT FACTOR ABOVE 100 KEV.

Q-VALUE WAS SET TO 7.233 MEV OBTAINED BY WEIGHTING AVERAGE.

MT = 16, 17, 22, 28, 32, 103, 104, 105, 106, 107, 111
(N,2N), (N,3N), (N,N'A), (N,N'P), (N,N'D), (N,P), (N,D), (N,T), (N,HE3), (N,ALPHA) AND (N,2P) CROSS SECTIONS

THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PRE-EQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS /11/. THE KALBACH'S CONSTANTS WERE ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/27/ AND LEVEL DENSITY PARAMETERS. THE (N,2N), (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES(MB) AT 14.5 MEV:

NUCLIDE	(N,2N)/28/	(N,P)/29/	(N,ALPHA)/29/
CD-106	900	(A)	100
CD-108	1000	57.6	12.1
CD-110	1170(B)	29.7	6.34
CD-111	(1582)	50	4.52
CD-112	(1583)	16	3.1
CD-113	(1632)	10.9	2.23
CD-114	(1631)	10	0.7
CD-116	(1632)	2.5	(0.108)

VALUES IN ( ) WERE CALCULATED ONES (NOT NORMALIZED).
(A) EYE-GUIDING OF DATA MEASURED BY BORMANN ET AL./30/
(B) SYSTEMATICS OF WEN DEN LU ET AL./31/

MT = 251 MU-BAR

CALCULATED FROM (MF=4, MT=2).

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS

DISTRIBUTIONS OF ELASTIC AND INELASTIC SCATTERING NEUTRONS WERE CALCULATED WITH CASTHY/8/. IN THE CASE WHERE MORE THAN 2 LEVELS WERE GROUPED INTO 1 LEVEL, ISOTROPIC DISTRIBUTIONS IN THE CENTER-OF-MASS SYSTEM WERE ASSUMED. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS

ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS/11/ FOR INELASTIC SCATTERING FROM OVERLAPPING LEVELS

AND FOR OTHER NEUTRON EMITTING REACTIONS.

MF = 12 PHOTON PRODUCTION MULTIPLICITIES
MT = 3 (ABOVE 100 KEV)
CALCULATED WITH GNASH/32/ MODIFIED BY YAMAMURO/33/
MT = 102 (BELOW 100 KEV)
CALCULATED FROM ENERGY BALANCE.

MF = 14 PHOTON ANGULAR DISTRIBUTIONS
MT = 3, 102
ISOTROPIC DISTRIBUTIONS WERE ASSUMED.

MF = 15 PHOTON ENERGY DISTRIBUTIONS
MT = 3 (ABOVE 100KEV)
CALCULATED WITH GNASH/32/ MODIFIED BY YAMAMURO/33/
MT = 102 (BELOW 100 KEV)
SPECTRA WERE CALCULATED WITH CASTHY FOR 8 ISOTOPES, REFERRING TO THE COMPILATION OF GAMMA-RAY SPECTRA FOR THERMAL NEUTRON BY M.A.LONE ET AL./34/, AT 1.0E-5, 2.53E-2, 1.0E+0, 1.0E+2, 1.0E+3 AND 1.0E+4 EV. PRIMARY TRANSITIONS WERE TAKEN INTO ACCOUNT FOR CD-111, CD-112, CD-113, CD-114 AND CD-116.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 50.01-0.5528E	R0 = 5.972	A0 = 0.56
WS = 8.165	RS = 6.594	AS = 0.44
WSO= 5.261	RSO= 5.97	ASO= 0.267

TABLE 2 LEVEL DENSITY PARAMETERS OF CD ISOTOPES

NUCLIDE	SYST	A(/MEV)	T(MEV)	C(/MEV)	EX(MEV)	PAIRING
48-CD-104	*	1.643E+01	6.403E-01	3.532E-01	7.266E+00	2.650E+00
48-CD-105		1.600E+01	6.850E-01	4.000E+00	6.612E+00	1.360E+00
48-CD-106		1.468E+01	6.950E-01	5.785E-01	7.078E+00	2.300E+00
48-CD-107		1.647E+01	6.740E-01	4.374E+00	6.626E+00	1.360E+00
48-CD-108		1.541E+01	6.900E-01	5.114E-01	7.655E+00	2.600E+00
48-CD-109		1.812E+01	6.120E-01	3.856E+00	6.132E+00	1.360E+00
48-CD-110		1.750E+01	6.300E-01	5.212E-01	7.482E+00	2.610E+00
48-CD-111		1.874E+01	5.930E-01	3.762E+00	6.000E+00	1.360E+00
48-CD-112		1.797E+01	6.190E-01	6.327E-01	7.351E+00	2.500E+00
48-CD-113		1.973E+01	5.760E-01	4.397E+00	6.018E+00	1.360E+00
48-CD-114		1.910E+01	6.010E-01	5.651E-01	7.611E+00	2.680E+00
48-CD-115		2.072E+01	5.570E-01	4.805E+00	5.966E+00	1.360E+00
48-CD-116		1.990E+01	5.750E-01	6.265E-01	7.206E+00	2.510E+00
48-CD-117		2.107E+01	5.620E-01	6.164E+00	6.181E+00	1.360E+00

SYST: * = LDP'S WERE DETERMINED FORM SYSTEMATICS.

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MAT number = 4825

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 48-CD-106 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 700 EV
    RESONANCE PARAMETERS WERE BASED ON MUGHABGHAB ET AL./2/
    NEUTRON ORBITAL ANGULAR MOMENTUM L OF SOME RESONANCES WAS
    ESTIMATED WITH A METHOD OF BOLLINGER AND THOMAS/3/.  AVERAGE
    RADIATION WIDTH OF 0.153 EV WAS DETERMINED FROM THE EXPERIMEN-
    TAL DATA OF MUSGROVE ET AL./4/ ABOVE 2.6 KEV.  SCATTERING
    RADIUS OF 6.5 FM WAS ADOPTED FROM THE SYSTEMATICS OF MEASURED
    VALUES.  A NEGATIVE RESONANCE WAS ADDED SO AS TO REPRODUCE THE
    THERMAL CAPTURE CROSS SECTION GIVEN BY MUGHABGHAB ET AL.

  UNRESOLVED RESONANCE REGION : 700 EV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0 AND S1 WERE BASED ON THE
    COMPILATION OF MUGHABGHAB ET AL., AND S2 WAS CALCULATED WITH
    OPTICAL MODEL CODE CASTHY/5/.  THE OBSERVED LEVEL SPACING WAS
    ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION MEASURED BY
    MUSGROVE ET AL./6,7/  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.  THE RADIATION WIDTHS, GG(S) AND GG(P), WERE BASED ON
    THE COMPILATION OF MUGHABGHAB ET AL.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 1.000E-4, S1 = 5.000E-4, S2 = 0.970E-4, SG(S)= 11.8E-4,
    SG(P)= 13.3E-4, GG(S)= 0.155 EV, GG(P)= 0.175 EV, R= 4.699 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                       2200 M/S               RES. INTEG.
      TOTAL             6.492                    -
      ELASTIC           5.522                    -
      CAPTURE           0.9695                 10.7

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/8/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE THE CD-NATURAL TOTAL CROSS SECTIONS
  MEASURED BY FOSTER AND GLASGOW/9/, POENITZ AND WHALEN/10/ AND
  SO ON.  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/11/
     ALPHA    = HUIZENGA AND IGO/12/
     DEUTERON = LOHR AND HAEBERLI/13/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/14/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/15/ WERE EVALUATED BY IIJIMA ET AL./16/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /17/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/18/ AND NUCLEAR DATA
    SHEETS/19/.

           NO.      ENERGY(MEV)    SPIN-PARITY    DWBA CAL.
           GR.       0.0              0  +
            1        0.6327           2  +            *
            2        1.4938           4  +
            3        1.7166           2  +
            4        2.1045           4  +
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5	2.3050	4	+	
6	2.3306	5	+	
7	2.3386	4	+	
8	2.3705	3	-	*
9	2.4856	4	+	
10	2.4917	6	+	
11	2.5031	6	+	

LEVELS ABOVE 2.522 MEV WERE ASSUMED TO BE OVERLAPPING.

FOR THE LEVELS WITH AN ASTERISK, THE CONTRIBUTION OF DIRECT INELASTIC SCATTERING CROSS SECTIONS WAS CALCULATED BY THE DWUCK-4 CODE/20/. DEFORMATION PARAMETERS (BETA2 = 0.1732 AND BETA3 = 0.194) WERE BASED ON THE DATA COMPILED BY RAMAN ET AL./21/ AND SPEAR/22/, RESPECTIVELY.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/23/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (1.42E-03) WAS ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION OF 340 MILLI-BARNS AT 70 KEV MEASURED BY MUSGROVE ET AL./6,7/

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT = 32 (N,N'D) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =106 (N,HE3) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
MT =111 (N,2P) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 122.0) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/24/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,2N) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,2N)	900.00 MB	(RECOMMENDED BY BYCHKOV+/25/)
(N,ALPHA)	100.00 MB	(RECOMMENDED BY FORREST/26/)

THE (N,P) CROSS SECTION WAS DETERMINED BY EYE-GUIDING OF THE DATA MEASURED BY BORMANN ET AL./27/

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. CONTRIBUTION OF DIRECT INELASTIC SCATTERING WAS CALCULATED WITH DWUCK-4. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING FROM OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 50.01-0.5528E	R0 = 5.972	A0 = 0.56
WS = 8.165	RS = 6.594	AS = 0.44
VSO= 5.261	RSO= 5.97	ASO= 0.267

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
46-PD-102		1.831E+01	6.210E-01	6.406E-01	7.665E+00	2.640E+00
46-PD-103		1.733E+01	6.550E-01	5.327E+00	6.637E+00	1.350E+00
46-PD-104		1.630E+01	6.650E-01	8.743E-01	7.305E+00	2.290E+00

46-PD-105		1.791E+01	6.700E-01	9.137E+00	7.207E+00	1.350E+00
47-AG-103	*	1.627E+01	6.427E-01	2.835E+00	5.882E+00	1.290E+00
47-AG-104	*	1.737E+01	6.403E-01	3.551E+01	5.016E+00	0.0
47-AG-105	*	1.848E+01	6.379E-01	1.390E+01	6.378E+00	9.400E-01
47-AG-106		1.839E+01	5.480E-01	1.824E+01	3.696E+00	0.0
48-CD-104	*	1.643E+01	6.403E-01	3.532E-01	7.266E+00	2.650E+00
48-CD-105		1.600E+01	6.850E-01	4.000E+00	6.612E+00	1.360E+00
48-CD-106		1.468E+01	6.950E-01	5.785E-01	7.078E+00	2.300E+00
48-CD-107		1.647E+01	6.740E-01	4.374E+00	6.626E+00	1.360E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 1.094 FOR CD-106 AND 5.0 FOR CD-107.

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MAT number = 4831

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 48-CD-108 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 380 EV
    RESONANCE PARAMETERS WERE BASED ON THE EXPERIMENTAL DATA OF
    ANUFRIEV ET AL./2/  NEUTRON ORBITAL ANGULAR MOMENTUM L WAS
    ESTIMATED WITH A METHOD OF BOLLINGER AND THOMAS/3/.
    SCATTERING RADIUS OF 6.5 FM WAS ASSUMED FROM THE SYSTEMATICS
    OF MEASURED VALUES FOR NEIGHBORING NUCLIDES.  A NEGATIVE
    RESONANCE WAS ADDED SO AS TO REPRODUCE THE THERMAL CAPTURE
    CROSS SECTION GIVEN BY MUGHABGHAB ET AL./4/

  UNRESOLVED RESONANCE REGION : 0.380 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0 AND S1 WERE BASED ON THE
    COMPILATION OF MUGHABGHAB ET AL./4/, AND S2 WAS CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/5/.  THE OBSERVED LEVEL SPACING
    WAS ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION MEASURED
    BY MUSGROVE ET AL./6,7/.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.  THE RADIATION WIDTHS, GG(S) AND GG(P), WERE BASED ON
    THE COMPILATION OF MUGHABGHAB ET AL.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 1.200E-4, S1 = 4.800E-4, S2 = 0.950E-4, SG(S)= 7.15E-4,
    SG(P)= 8.51E-4, GG(S)= 0.105 EV, GG(P)= 0.125 EV, R= 4.590 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           6.619                   -
      ELASTIC         5.533                   -
      CAPTURE         1.087                  27.2

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/8/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE THE CD-NATURAL TOTAL CROSS SECTIONS
  MEASURED BY FOSTER AND GLASGOW/9/, POENITZ AND WHALEN/10/ AND
  SO ON.  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/11/
     ALPHA    = HUIZENGA AND IGO/12/
     DEUTERON = LOHR AND HAEBERLI/13/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/14/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/15/ WERE EVALUATED BY IIJIMA ET AL./16/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /17/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/18/ AND NUCLEAR DATA
    SHEETS /19/.

           NO.      ENERGY(MEV)    SPIN-PARITY   DWBA CAL.
           GR.       0.0             0  +
            1        0.6330          2  +            *
            2        1.5084          4  +
            3        1.6017          2  +
            4        1.7210          0  +
            5        1.9132          2  +
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                6         1.9380          0  +
                7         2.1627          2  -
                8         2.2023          3  -            *
                9         2.2393          2  +
               10         2.3655          2  +
               11         2.5000          0  +
               12         2.5413          6  +
               13         2.5649          5  +
               14         2.6015          5  -
               15         2.6197          2  +
               16         2.6750          0  -
               17         2.6817          2  +
               18         2.7069          5  -
               19         2.7400          0  +
               20         2.8077          5  +
               21         2.9753          6  -
               22         2.9941          6  +
               23         3.0467          2  +
               24         3.0574          7  -
               25         3.0760          0  +
               26         3.1105          6  +
               27         3.1380          0  -
          LEVELS ABOVE 3.17 MEV WERE ASSUMED TO BE OVERLAPPING.

        FOR THE LEVELS WITH AN ASTERISK, THE CONTRIBUTION OF DIRECT
        INELASTIC SCATTERING CROSS SECTIONS WAS CALCULATED BY THE
        DWUCK-4 CODE/20/.  DEFORMATION PARAMETER (BETA2 = 0.1752) WAS
        BASED ON THE DATA COMPILED BY RAMAN ET AL./21/ AND BETA3 =
        0.207 WAS PRESENTLY DETERMINED.

      MT = 102  CAPTURE
        SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
        CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
        SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
        AND REFFO/22/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

        THE GAMMA-RAY STRENGTH FUNCTION (8.63E-04) WAS ADJUSTED TO
        REPRODUCE THE CAPTURE CROSS SECTION OF 230 MILLI-BARNS AT 70
        KEV MEASURED BY MUSGROVE ET AL./6,7/

      MT = 16  (N,2N) CROSS SECTION
      MT = 17  (N,3N) CROSS SECTION
      MT = 22  (N,N'A) CROSS SECTION
      MT = 28  (N,N'P) CROSS SECTION
      MT = 32  (N,N'D) CROSS SECTION
      MT =103  (N,P) CROSS SECTION
      MT =104  (N,D) CROSS SECTION
      MT =105  (N,T) CROSS SECTION
      MT =106  (N,HE3) CROSS SECTION
      MT =107  (N,ALPHA) CROSS SECTION
      MT =111  (N,2P) CROSS SECTION
        THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
        PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

        THE KALBACH'S CONSTANT K (=  97.0) WAS ESTIMATED BY THE
        FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/23/ AND LEVEL
        DENSITY PARAMETERS.

        FINALLY, THE (N,2N), (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
        NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
          (N,2N)      1000.00  MB (RECOMMENDED BY BYCHKOV+/24/)
          (N,P)         57.60  MB (SYSTEMATICS OF FORREST/25/)
          (N,ALPHA)     12.10  MB (SYSTEMATICS OF FORREST)

      MT = 251  MU-BAR
        CALCULATED WITH CASTHY.

    MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
      LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
      GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
      TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
      CALCULATED WITH CASTHY.  CONTRIBUTION OF DIRECT INELASTIC
      SCATTERING WAS CALCULATED WITH DWUCK-4.  FOR OTHER REACTIONS,
      ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

    MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
      ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
      PEGASUS FOR INELASTIC SCATTERING FROM OVERLAPPING LEVELS AND FOR
      OTHER NEUTRON EMITTING REACTIONS.

    TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS
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	DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
	V = 50.01-0.5528E	R0 = 5.972	A0 = 0.56
	WS = 8.165	RS = 6.594	AS = 0.44
	VSO= 5.261	RSO= 5.97	ASO= 0.267

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
46-PD-104		1.630E+01	6.650E-01	8.743E-01	7.305E+00	2.290E+00
46-PD-105		1.791E+01	6.700E-01	9.137E+00	7.207E+00	1.350E+00
46-PD-106		1.717E+01	6.660E-01	8.922E-01	8.024E+00	2.590E+00
46-PD-107		1.916E+01	6.110E-01	6.467E+00	6.507E+00	1.350E+00
47-AG-105	*	1.848E+01	6.379E-01	1.390E+01	6.378E+00	9.400E-01
47-AG-106		1.839E+01	5.480E-01	1.824E+01	3.696E+00	0.0
47-AG-107		1.650E+01	6.300E-01	2.823E+00	5.699E+00	1.240E+00
47-AG-108		1.671E+01	5.760E-01	1.221E+01	3.609E+00	0.0
48-CD-106		1.468E+01	6.950E-01	5.785E-01	7.078E+00	2.300E+00
48-CD-107		1.647E+01	6.740E-01	4.374E+00	6.626E+00	1.360E+00
48-CD-108		1.541E+01	6.900E-01	5.114E-01	7.655E+00	2.600E+00
48-CD-109		1.812E+01	6.120E-01	3.856E+00	6.132E+00	1.360E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 8.088 FOR CD-108 AND 5.0 FOR CD-109.

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MAT number = 4837

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 48-CD-110 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-SEP90 REV2-NOV93
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.
93-12 JENDL-3.2 WAS MADE BY JNDC FPND W.G.

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)       PARAMETERS OF A NEGATIVE RESONANCE ONLY.
     ***********************************************************


MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 7 KEV
    RESONANCE PARAMETERS WERE TAKEN FROM JENDL-2, AND SLIGHTLY
    MODIFIED FOR JENDL-3.2.
       FOR JENDL-2, EVALUATION WAS MADE ON THE BASIS OF EXPERI-
    MENTAL DATA OF LIOU ET AL./3/ AND MUSGROVE ET AL./4/ THE
    AVERAGE RADIATION WIDTH WAS ASSUMED TO BE 0.1 EV/3/ BELOW 3.1
    KEV, AND TO BE 0.071 EV FOR S-WAVE LEVELS AND 0.084 EV FOR
    P-WAVE ONES/4/ ABOVE 3.1 KEV.  A NEGATIVE RESONANCE WAS ADDED
    SO AS TO REPRODUCE THE THERMAL CAPTURE AND TOTAL CROSS
    SECTIONS GIVEN BY MUGHABGHAB ET AL./5/
       FOR JENDL-3.2, THE PARAMETERS OF THE NEGATIVE RESONANCE
    WERE ADJUSTED TO DECREASE THE ELASTIC SCATTERING CROSS SECTION
    IN THE ENERGY REGION BELOW ABOUT 1 KEV.  THIS MODIFICATION WAS
    NEEDED TO IMPROVE THE TOTAL CROSS SECTION OF NATURAL CD AROUND
    10 EV.

  UNRESOLVED RESONANCE REGION : 7 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0 AND S1 WERE BASED ON THE
    COMPILATION OF MUGHABGHAB ET AL./5/, AND S2 WAS CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/6/.  THE OBSERVED LEVEL SPACING
    WERE DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.  THE RADIATION WIDTHS, GG(S) AND GG(P), WERE BASED ON
    THE COMPILATION OF MUGHABGHAB ET AL.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.440E-4, S1 = 3.000E-4, S2 = 0.930E-4, SG(S)= 4.57E-4,
    SG(P)= 5.15E-4, GG(S)= 0.071 EV, GG(P)= 0.080 EV, R= 6.251 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL         16.928                     -
      ELASTIC        5.874                     -
      CAPTURE       11.054                   39.3

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/7/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE THE CD-NATURAL TOTAL CROSS SECTIONS
  MEASURED BY FOSTER AND GLASGOW/8/, POENITZ AND WHALEN/9/ AND
  SO ON.  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/10/
     ALPHA    = HUIZENGA AND IGO/11/
     DEUTERON = LOHR AND HAEBERLI/12/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/13/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/14/ WERE EVALUATED BY IIJIMA ET AL./15/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /16/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).
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MT = 4, 51 - 91 INELASTIC SCATTERING
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS ADOPTED. THE LEVEL SCHEME WAS TAKEN FROM REF./17/.

NO.	ENERGY(MEV)	SPIN-PARITY	DWBA CAL.
GR.	0.0	0 +	
1	0.6577	2 +	*
2	1.4732	0 +	
3	1.4757	2 +	
4	1.5424	4 +	
5	1.7320	3 +	
6	1.7833	1 +	
7	1.8092	3 +	
8	2.0042	5 -	
9	2.0788	3 -	*
10	2.1245	5 -	
11	2.1627	3 +	
12	2.2200	4 +	
13	2.3550	3 +	
14	2.4641	3 +	
15	2.4798	6 +	
16	2.5380	5 -	
17	2.5612	4 +	
18	2.7864	2 +	
19	2.8680	2 +	
20	2.8780	7 -	
21	2.9266	5 +	

LEVELS ABOVE 2.974 MEV WERE ASSUMED TO BE OVERLAPPING.

FOR THE LEVELS WITH AN ASTERISK, THE CONTRIBUTION OF DIRECT INELASTIC SCATTERING CROSS SECTIONS WAS CALCULATED BY THE DWUCK-4 CODE/18/. DEFORMATION PARAMETERS (BETA2 = 0.1771 AND BETA3 = 0.168) WERE BASED ON THE DATA COMPILED BY RAMAN ET AL./19/ AND SPEAR/20/, RESPECTIVELY.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/21/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (4.65E-04) WAS ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION OF 245 MILLI-BARNS AT 30 KEV MEASURED BY MUSGROVE ET AL./22/

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 92.5) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/23/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,2N), (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,2N)	1170.00 MB	(SYSTEMATICS OF WEN DEN LU+/24/)
(N,P)	29.70 MB	(SYSTEMATICS OF FORREST/25/)
(N,ALPHA)	6.34 MB	(SYSTEMATICS OF FORREST)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. CONTRIBUTION OF DIRECT INELASTIC SCATTERING WAS CALCULATED WITH DWUCK-4. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING FROM OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

	DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
	V = 50.01-0.5528E	R0 = 5.972	A0 = 0.56
	WS = 8.165	RS = 6.594	AS = 0.44
	VSO= 5.261	RSO= 5.97	ASO= 0.267

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
46-PD-106	1.717E+01	6.660E-01	8.922E-01	8.024E+00	2.590E+00
46-PD-107	1.916E+01	6.110E-01	6.467E+00	6.507E+00	1.350E+00
46-PD-108	1.790E+01	6.460E-01	8.844E-01	7.957E+00	2.600E+00
46-PD-109	2.071E+01	6.030E-01	1.194E+01	6.925E+00	1.350E+00
47-AG-107	1.650E+01	6.300E-01	2.823E+00	5.699E+00	1.240E+00
47-AG-108	1.671E+01	5.760E-01	1.221E+01	3.609E+00	0.0
47-AG-109	1.650E+01	6.300E-01	2.761E+00	5.709E+00	1.250E+00
47-AG-110	1.791E+01	5.900E-01	2.444E+01	4.282E+00	0.0
48-CD-108	1.541E+01	6.900E-01	5.114E-01	7.655E+00	2.600E+00
48-CD-109	1.812E+01	6.120E-01	3.856E+00	6.132E+00	1.360E+00
48-CD-110	1.750E+01	6.300E-01	5.212E-01	7.482E+00	2.610E+00
48-CD-111	1.874E+01	5.930E-01	3.762E+00	6.000E+00	1.360E+00

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 9.077 FOR CD-110 AND 4.636 FOR CD-111.

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MAT number = 4840

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 48-CD-111 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-SEP90 REV2-NOV93
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.
93-12 JENDL-3.2 WAS MADE BY JNDC FPND W.G.

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)       RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
      (3,102)       RENORMALIZATION TO RECENT EXPERIMENT
      (3,2), (3,4), (3,51-91), (4,51-91)
                    EFFECTS OF RENORMALIZATION OF CAPTURE
     ***********************************************************


MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 1.8 KEV
    RESONANCE PARAMETERS OF JENDL-2 WERE MODIFIED FOR JENDL-3.
       FOR JENDL-2, EVALUATION WAS MADE ON THE BASIS OF EXPERIMEN-
    TAL DATA OF LIOU ET AL./3/ AND WASSON AND ALLEN/4/.  THE
    AVERAGE RADIATION WIDTH WAS ASSUMED TO BE 0.102 EV/3/.
    SCATTERING RADIUS OF 6.5 FM WAS ASSUMED ON THE BASIS OF
    SYSTEMATICS OF MEASURED VALUES.
       FOR JENDL-3, THE LOWEST TWO P-WAVE RESONANCES WERE ADDED
    ACCORDING TO THE DATA BY ALFIMENKOV ET AL./5/  TOTAL SPIN J
    OF SOME RESONANCES WAS TENTATIVELY ESTIMATED WITH A RANDOM
    NUMBER METHOD.  PARAMETERS OF A NEGATIVE RESONANCE WERE
    MODIFIED SO AS TO REPRODUCE THE THERMAL CAPTURE AND ELASTIC
    SCATTERING CROSS SECTIONS GIVEN BY MUGHABGHAB ET AL./6/
       FOR JENDL-3.2, THE CAPTURE DATA MEASURED AT ORERA OF ORNL
    WERE RENORMALIZED (FACTOR=1.208)/7/.  THE NEUTRON AND/OR
    RADIATION WIDTH WERE REVISED TO REPRODUCE THE NORMALIZED
    CAPTURE AREA FOR EACH RESONANCE ABOVE 2.76 EV.

  UNRESOLVED RESONANCE REGION : 1.8 KEV - 100 KEV
    THE SAME PARAMETER VALUES AS JENDL-2 WERE USED AS INITIAL
    VALUES.  THEN THE PARAMETERS WERE ADJUSTED TO REPRODUCE THE
    CAPTURE CROSS SECTION CALCULATED WITH CASTHY /8/ (SEE MF=3,
    MT=102) ABOVE 15 KEV AND THOSE MEASURED BY MUSGROVE ET AL./9/
    BELOW 15 KEV.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.450E-4, S1 = 3.900E-4, S2 = 0.530E-4, SG = 101.E-4,
    GG = 0.160 EV, R  = 5.763 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S                RES. INTEG.
      TOTAL          29.013                     -
      ELASTIC         5.074                     -
      CAPTURE        23.939                    49.9

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY/8/, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/10/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE THE CD-NATURAL TOTAL CROSS SECTIONS
  MEASURED BY FOSTER AND GLASGOW/11/, POENITZ AND WHALEN/12/ AND
  SO ON.  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/13/
     ALPHA    = HUIZENGA AND IGO/14/
     DEUTERON = LOHR AND HAEBERLI/15/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/16/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/17/ WERE EVALUATED BY IIJIMA ET AL./18/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /19/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.
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MT = 2 ELASTIC SCATTERING
CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

MT = 4, 51 - 91 INELASTIC SCATTERING
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS ADOPTED. THE LEVEL SCHEME WAS TAKEN FROM REF./20/.

NO.	ENERGY(MEV)	SPIN-PARITY
GR.	0.0	1/2 +
1	0.2454	5/2 +
2	0.3419	3/2 +
3	0.3960	11/2 -
4	0.4166	7/2 +
5	0.6200	5/2 +
6	0.7000	3/2 +
7	0.7540	5/2 +
8	0.8665	3/2 +
9	1.0200	1/2 +
10	1.1300	5/2 +
11	1.1900	1/2 +

LEVELS ABOVE 1.33 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/21/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (1.032E-02) WAS ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION OF 664 MILLI-BARNS AT 90 KEV MEASURED BY MUSGROVE ET AL./9/

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT = 32 (N,N'D) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 107.8) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/22/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,P)	50.00 MB	(RECOMMENDED BY FORREST/23/)
(N,ALPHA)	4.52 MB	(SYSTEMATICS OF FORREST/23/)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING FROM OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 50.01-0.5528E	R0 = 5.972	A0 = 0.56
WS = 8.165	RS = 6.594	AS = 0.44
VSO= 5.261	RSO= 5.97	ASO= 0.267

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
46-PD-107	1.916E+01	6.110E-01	6.467E+00	6.507E+00	1.350E+00

46-PD-108	1.790E+01	6.460E-01	8.844E-01	7.957E+00	2.600E+00
46-PD-109	2.071E+01	6.030E-01	1.194E+01	6.925E+00	1.350E+00
46-PD-110	1.880E+01	6.300E-01	1.215E+00	7.897E+00	2.490E+00
47-AG-108	1.671E+01	5.760E-01	1.221E+01	3.609E+00	0.0
47-AG-109	1.650E+01	6.300E-01	2.761E+00	5.709E+00	1.250E+00
47-AG-110	1.791E+01	5.900E-01	2.444E+01	4.282E+00	0.0
47-AG-111	1.955E+01	5.810E-01	6.505E+00	5.835E+00	1.140E+00
48-CD-109	1.812E+01	6.120E-01	3.856E+00	6.132E+00	1.360E+00
48-CD-110	1.750E+01	6.300E-01	5.212E-01	7.482E+00	2.610E+00
48-CD-111	1.874E+01	5.930E-01	3.762E+00	6.000E+00	1.360E+00
48-CD-112	1.797E+01	6.190E-01	6.327E-01	7.351E+00	2.500E+00

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 4.636 FOR CD-111 AND 3.236 FOR CD-112.

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MAT number = 4843

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 48-CD-112 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 7 KEV.
    PARAMETERS WERE TAKEN FROM JENDL-2.  FOR JENDL-2, EVALUATION
    WAS MADE ON THE BASIS OF EXPERIMENTAL DATA OF LIOU ET AL./3/
    AND MUSGROVE ET AL./4/  THE AVERAGE RADIATION WIDTH OF S-WAVE
    RESONANCES WAS ASSUMED TO BE 0.1 EV/3/ BELOW 2.0 KEV, AND TO
    BE 0.077 EV ABOVE 2.0 KEV.  FOR P-WAVE ONES, THE AVERAGE WIDTH
    OF 0.096 EV/4/ WAS ASSUMED.  A NEGATIVE RESONANCE WAS ADDED SO
    AS TO REPRODUCE THE THERMAL CAPTURE AND SCATTERING CROSS
    SECTIONS GIVEN BY MUGHABGHAB ET AL./5/

  UNRESOLVED RESONANCE REGION : 7 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0 AND S1 WERE BASED ON THE
    COMPILATION OF MUGHABGHAB ET AL./5/, AND S2 WAS CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/6/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.  THE RADIATION WIDTHS, GG(S) AND GG(P), WERE BASED ON
    THE COMPILATION OF MUGHABGHAB ET AL.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.500E-4, S1 = 4.400E-4, S2 = 0.910E-4, SG(S)= 3.63E-4,
    SG(P)= 4.24E-4, GG(S)= 0.077 EV, GG(P)= 0.090 EV, R= 5.439 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S                RES. INTEG.
      TOTAL           9.211                     -
      ELASTIC         7.019                     -
      CAPTURE         2.192                    13.4

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/7/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE THE CD-NATURAL TOTAL CROSS SECTIONS
  MEASURED BY FOSTER AND GLASGOW/8/, POENITZ AND WHALEN/9/ AND
  SO ON.  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/10/
     ALPHA    = HUIZENGA AND IGO/11/
     DEUTERON = LOHR AND HAEBERLI/12/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/13/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/14/ WERE EVALUATED BY IIJIMA ET AL./15/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /16/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./17/.

           NO.      ENERGY(MEV)    SPIN-PARITY   DWBA CAL.
           GR.       0.0             0  +
            1        0.6174          2  +           *
            2        1.2230          0  +
            3        1.3116          2  +
            4        1.4142          4  +
            5        1.4317          0  +
            6        1.4682          2  +
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7	1.8697	0	+	
8	1.9710	3	-	*
9	2.0038	2	-	

LEVELS ABOVE 2.047 MEV WERE ASSUMED TO BE OVERLAPPING.

FOR THE LEVELS WITH AN ASTERISK, THE CONTRIBUTION OF DIRECT INELASTIC SCATTERING CROSS SECTIONS WAS CALCULATED BY THE DWUCK-4 CODE/18/. DEFORMATION PARAMETERS (BETA2 = 0.1863 AND BETA3 = 0.162) WERE BASED ON THE DATA COMPILED BY RAMAN ET AL./19/ AND SPEAR/20/, RESPECTIVELY.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/21/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (4.04E-04) WAS ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION OF 220 MILLI-BARNS AT 30 KEV MEASURED BY MUSGROVE ET AL./22/

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 83.6) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/23/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,P)	16.00 MB	(RECOMMENDED BY FORREST/24/)
(N,ALPHA)	3.10 MB	(RECOMMENDED BY FORREST)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. CONTRIBUTION OF DIRECT INELASTIC SCATTERING WAS CALCULATED WITH DWUCK-4. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING FROM OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 50.01-0.5528E	R0 = 5.972	A0 = 0.56
WS = 8.165	RS = 6.594	AS = 0.44
VSO= 5.261	RSO= 5.97	ASO= 0.267

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
46-PD-108		1.790E+01	6.460E-01	8.844E-01	7.957E+00	2.600E+00
46-PD-109		2.071E+01	6.030E-01	1.194E+01	6.925E+00	1.350E+00
46-PD-110		1.880E+01	6.300E-01	1.215E+00	7.897E+00	2.490E+00
46-PD-111		2.143E+01	5.610E-01	7.376E+00	6.267E+00	1.350E+00
47-AG-109		1.650E+01	6.300E-01	2.761E+00	5.709E+00	1.250E+00
47-AG-110		1.791E+01	5.900E-01	2.444E+01	4.282E+00	0.0
47-AG-111		1.955E+01	5.810E-01	6.505E+00	5.835E+00	1.140E+00
47-AG-112	*	1.857E+01	6.210E-01	4.959E+01	5.129E+00	0.0
48-CD-110		1.750E+01	6.300E-01	5.212E-01	7.482E+00	2.610E+00
48-CD-111		1.874E+01	5.930E-01	3.762E+00	6.000E+00	1.360E+00

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48-CD-112     1.797E+01 6.190E-01 6.327E-01 7.351E+00 2.500E+00
48-CD-113     1.973E+01 5.760E-01 4.397E+00 6.018E+00 1.360E+00
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 SYST:  * = LDP'S WERE DETERMINED FROM SYSTEMATICS.
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SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 3.236 FOR CD-112 AND 5.733 FOR CD-113.

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MAT number = 4846

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 48-CD-113 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-SEP90 REV2-AUG93
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.
93-08 JENDL-3.2 WAS MADE BY JNDC FPND W.G.

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)       THE UPPER BOUNDARY OF RESOLVED RESONANCE
                    REGION WAS CHANGED FROM 2.0 KEV TO 1.0 KEV
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MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 1.0 KEV
    FOR JENDL-2, EVALUATION WAS MADE ON THE BASIS OF THE DATA
    MEASURED BY LIOU ET AL./3/  THE AVERAGE RADIATION WIDTH OF
    0.101 EV/3/ WAS ASSUMED FOR S-WAVE LEVELS.  FOR JENDL-3, TOTAL
    SPIN J OF SOME RESONANCES WAS TENTATIVELY ESTIMATED WITH A
    RANDOM NUMBER METHOD.

  UNRESOLVED RESONANCE REGION : 1 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0 AND S1 WERE BASED ON THE
    COMPILATION OF MUGHABGHAB ET AL./4/, AND S2 WAS CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/5/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY ABOVE 10 KEV.  BELOW 10 KEV, THE SAME
    PARAMETERS AS 10 KEV WERE ADOPTED.  THE EFFECTIVE SCATTERING
    RADIUS WAS OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS
    SECTION AT 100 KEV.  THE RADIATION WIDTH GG WAS BASED ON THE
    COMPILATION OF MUGHABGHAB ET AL.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.310E-4, S1 = 2.200E-4, S2 = 0.900E-4, SG = 58.4E-4,
    GG = 0.160 EV, R  = 6.739 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                   2200 M/S              RES. INTEG.
      TOTAL       20670                      -
      ELASTIC        25.47                   -
      CAPTURE     20650                     395

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/6/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE THE CD-NATURAL TOTAL CROSS SECTIONS
  MEASURED BY FOSTER AND GLASGOW/7/, POENITZ AND WHALEN/8/ AND
  SO ON.  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/9/
     ALPHA    = HUIZENGA AND IGO/10/
     DEUTERON = LOHR AND HAEBERLI/11/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/12/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/13/ WERE EVALUATED BY IIJIMA ET AL./14/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /15/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./16/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             1/2 -
            1        0.2636         11/2 -
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2	0.2986	3/2 +
3	0.3163	5/2 +
4	0.4596	7/2 +
5	0.4810	9/2 -
6	0.5223	7/2 -
7	0.5840	5/2 +
8	0.6810	3/2 +
9	0.7085	5/2 +
10	0.8553	5/2 -
11	0.8836	1/2 +
12	0.9884	1/2 +
13	1.0080	9/2 +
14	1.1261	3/2 +
15	1.1946	3/2 -

LEVELS ABOVE 1.195 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/17/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (4.63E-03) WAS ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION OF 720 MILLI-BARNS AT 30 KEV MEASURED BY MUSGROVE ET AL./18/

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT = 32 (N,N'D) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 94.6) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/19/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,P)	10.90 MB	(SYSTEMATICS OF FORREST/20/)
(N,ALPHA)	2.23 MB	(SYSTEMATICS OF FORREST)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING FROM OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 50.01-0.5528E	R0 = 5.972	A0 = 0.56
WS = 8.165	RS = 6.594	AS = 0.44
VSO= 5.261	RSO= 5.97	ASO= 0.267

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
46-PD-109		2.071E+01	6.030E-01	1.194E+01	6.925E+00	1.350E+00
46-PD-110		1.880E+01	6.300E-01	1.215E+00	7.897E+00	2.490E+00
46-PD-111		2.143E+01	5.610E-01	7.376E+00	6.267E+00	1.350E+00
46-PD-112	*	1.821E+01	6.210E-01	5.620E-01	7.654E+00	2.670E+00
47-AG-110		1.791E+01	5.900E-01	2.444E+01	4.282E+00	0.0
47-AG-111		1.955E+01	5.810E-01	6.505E+00	5.835E+00	1.140E+00

47-AG-112	*	1.857E+01	6.210E-01	4.959E+01	5.129E+00	0.0
47-AG-113	*	1.837E+01	6.185E-01	5.132E+00	6.321E+00	1.320E+00
48-CD-111		1.874E+01	5.930E-01	3.762E+00	6.000E+00	1.360E+00
48-CD-112		1.797E+01	6.190E-01	6.327E-01	7.351E+00	2.500E+00
48-CD-113		1.973E+01	5.760E-01	4.397E+00	6.018E+00	1.360E+00
48-CD-114		1.910E+01	6.010E-01	5.651E-01	7.611E+00	2.680E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 5.733 FOR CD-113 AND 3.875 FOR CD-114.

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MAT number = 4849

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 48-CD-114 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 8 KEV
       FOR JENDL-2, EVALUATION WAS MADE ON THE BASIS OF EXPERIMEN-
    TAL DATA OF LIOU ET AL./3/ AND MUSGROVE ET AL./4/  THE AVERAGE
    RADIATION WIDTH OF S-WAVE RESONANCES WAS ASSUMED TO BE 0.11
    EV/3/ BELOW 2.0 KEV, AND TO BE 0.053 EV ABOVE 2.0 KEV.  FOR
    P-WAVE ONES, THE AVERAGE WIDTH OF 0.082 EV/4/ WAS ASSUMED.
       FOR JENDL-3, PARAMETERS OF A NEGATIVE RESONANCE AND
    SCATTERING RADIUS WERE MODIFIED SO AS TO REPRODUCE THE THERMAL
    CAPTURE AND ELASTIC SCATTERING CROSS SECTIONS GIVEN BY
    MUGHABGHAB ET AL./5/

  UNRESOLVED RESONANCE REGION : 8 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0 AND S1 WERE BASED ON THE
    COMPILATION OF MUGHABGHAB ET AL./5/, AND S2 WAS CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/6/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.  THE RADIATION WIDTHS, GG(S) AND GG(P), WERE BASED ON
    THE COMPILATION OF MUGHABGHAB ET AL.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.640E-4, S1 = 3.500E-4, S2 = 0.890E-4, SG(S)= 2.12E-4,
    SG(P)= 2.80E-4, GG(S)= 0.053 EV, GG(P)= 0.070 EV, R= 5.804 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S                RES. INTEG.
      TOTAL           6.240                    -
      ELASTIC         5.900                    -
      CAPTURE         0.3404                  17.0

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/7/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE THE CD-NATURAL TOTAL CROSS SECTIONS
  MEASURED BY FOSTER AND GLASGOW/8/, POENITZ AND WHALEN/9/ AND
  SO ON.  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/10/
     ALPHA    = HUIZENGA AND IGO/11/
     DEUTERON = LOHR AND HAEBERLI/12/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/13/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/14/ WERE EVALUATED BY IIJIMA ET AL./15/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /16/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./17/.
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NO.	ENERGY(MEV)	SPIN-PARITY	DWBA CAL.
GR.	0.0	0 +	
1	0.5583	2 +	*
2	1.1342	0 +	
3	1.2093	2 +	
4	1.2833	4 +	
5	1.3052	0 +	

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          6        1.3639           2  +
          7        1.7318           4  +
          8        1.7571           1  +
    LEVELS ABOVE 1.776 MEV WERE ASSUMED TO BE OVERLAPPING.

  FOR THE LEVELS WITH AN ASTERISK, THE CONTRIBUTION OF DIRECT
  INELASTIC SCATTERING CROSS SECTIONS WAS CALCULATED BY THE
  DWUCK-4 CODE/18/.  DEFORMATION PARAMETER (BETA2 = 0.1912) WAS
  BASED ON THE DATA COMPILED BY RAMAN ET AL./19/

MT = 102  CAPTURE
  SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
  CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
  SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
  AND REFFO/20/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

  THE GAMMA-RAY STRENGTH FUNCTION (2.50E-04) WAS ADJUSTED TO
  REPRODUCE THE CAPTURE CROSS SECTION OF 150 MILLI-BARNS AT 30
  KEV MEASURED BY MUSGROVE ET AL./21/

MT = 16  (N,2N) CROSS SECTION
MT = 17  (N,3N) CROSS SECTION
MT = 22  (N,N'A) CROSS SECTION
MT = 28  (N,N'P) CROSS SECTION
MT =103  (N,P) CROSS SECTION
MT =104  (N,D) CROSS SECTION
MT =105  (N,T) CROSS SECTION
MT =107  (N,ALPHA) CROSS SECTION
  THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
  PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

  THE KALBACH'S CONSTANT K (=  76.1) WAS ESTIMATED BY THE
  FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/22/ AND LEVEL
  DENSITY PARAMETERS.

  FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
  NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
    (N,P)         10.00  MB (RECOMMENDED BY FORREST/23/)
    (N,ALPHA)      0.70  MB (RECOMMENDED BY FORREST)

MT = 251  MU-BAR
  CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  CONTRIBUTION OF DIRECT INELASTIC
  SCATTERING WAS CALCULATED WITH DWUCK-4.  FOR OTHER REACTIONS,
  ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING FROM OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

              DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
         ----------------------  ------------  ---------------
        V  = 50.01-0.5528E       R0 = 5.972    A0 = 0.56
        WS = 8.165               RS = 6.594    AS = 0.44
        VSO= 5.261               RSO= 5.97     ASO= 0.267
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2  LEVEL DENSITY PARAMETERS

 NUCLIDE   SYST A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)    PAIRING
 ---------------------------------------------------------------
 46-PD-110      1.880E+01 6.300E-01 1.215E+00 7.897E+00 2.490E+00
 46-PD-111      2.143E+01 5.610E-01 7.376E+00 6.267E+00 1.350E+00
 46-PD-112   *  1.821E+01 6.210E-01 5.620E-01 7.654E+00 2.670E+00
 46-PD-113   *  1.800E+01 6.185E-01 4.082E+00 6.206E+00 1.350E+00

 47-AG-111      1.955E+01 5.810E-01 6.505E+00 5.835E+00 1.140E+00
 47-AG-112   *  1.857E+01 6.210E-01 4.959E+01 5.129E+00 0.0
 47-AG-113   *  1.837E+01 6.185E-01 5.132E+00 6.321E+00 1.320E+00
 47-AG-114   *  1.816E+01 6.161E-01 3.785E+01 4.871E+00 0.0

 48-CD-112      1.797E+01 6.190E-01 6.327E-01 7.351E+00 2.500E+00
 48-CD-113      1.973E+01 5.760E-01 4.397E+00 6.018E+00 1.360E+00
 48-CD-114      1.910E+01 6.010E-01 5.651E-01 7.611E+00 2.680E+00
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48-CD-115      2.072E+01 5.570E-01 4.805E+00 5.966E+00 1.360E+00
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 SYST:  * = LDP'S WERE DETERMINED FROM SYSTEMATICS.
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SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 3.875 FOR CD-114 AND 5.0 FOR CD-115.

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MAT number = 4855

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 48-CD-116 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 9 KEV
    PARAMETERS WERE TAKEN FROM JENDL-2.  EVALUATION FOR JENDL-2
    WAS MADE ON THE BASIS OF EXPERIMENTAL DATA OF LIOU ET AL./3/
    AND MUSGROVE ET AL./4/  THE AVERAGE RADIATIVE CAPTURE WIDTH
    WAS ASSUMED TO BE 0.047 EV FOR S-WAVE LEVELS AND 0.085 EV FOR
    P-WAVE ONES/4/.  A NEGATIVE RESONANCE WAS ADDED SO AS TO
    REPRODUCE THE THERMAL CAPTURE AND SCATTERING CROSS SECTIONS
    GIVEN BY MUGHABGHAB ET AL./5/

  UNRESOLVED RESONANCE REGION : 9 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0 AND S1 WERE BASED ON THE
    COMPILATION OF MUGHABGHAB ET AL., AND S2 WAS CALCULATED WITH
    OPTICAL MODEL CODE CASTHY/6/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTHS, GG(S) AND GG(P), WERE BASED ON THE
    COMPILATION OF MUGHABGHAB ET AL.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.160E-4, S1 = 2.800E-4, S2 = 0.870E-4, SG(S)= 1.09E-4,
    SG(P)= 1.62E-4, GG(S)= 0.047 EV, GG(P)= 0.070 EV, R= 6.488 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL          6.058                     -
      ELASTIC        5.983                     -
      CAPTURE        0.07484                  1.75

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/7/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE THE CD-NATURAL TOTAL CROSS SECTIONS
  MEASURED BY FOSTER AND GLASGOW/8/, POENITZ AND WHALEN/9/ AND
  SO ON.  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/10/
     ALPHA    = HUIZENGA AND IGO/11/
     DEUTERON = LOHR AND HAEBERLI/12/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/13/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/14/ WERE EVALUATED BY IIJIMA ET AL./15/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /16/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./17/.

           NO.      ENERGY(MEV)    SPIN-PARITY    DWBA CAL.
           GR.      0.0              0  +
            1       0.5131           2  +            *
            2       1.2130           2  +
            3       1.2190           4  +
            4       1.2830           2  +
            5       1.3610           0  +
      LEVELS ABOVE 1.644 MEV WERE ASSUMED TO BE OVERLAPPING.
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    FOR THE LEVELS WITH AN ASTERISK, THE CONTRIBUTION OF DIRECT
    INELASTIC SCATTERING CROSS SECTIONS WAS CALCULATED BY THE
    DWUCK-4 CODE/18/.  DEFORMATION PARAMETER (BETA2 = 0.1907) WAS
    BASED ON THE DATA COMPILED BY RAMAN ET AL./19/

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/20/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (1.35E-04) WAS ADJUSTED TO
    REPRODUCE THE CAPTURE CROSS SECTION OF 90 MILLI-BARNS AT 30
    KEV MEASURED BY MUSGROVE ET AL./21/

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (=  76.2) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/22/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,P) CROSS SECTION WAS NORMALIZED TO THE
    FOLLOWING VALUE AT 14.5 MEV:
      (N,P)          2.50  MB (RECOMMENDED BY FORREST/23/)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  CONTRIBUTION OF DIRECT INELASTIC
  SCATTERING WAS CALCULATED WITH DWUCK-4.  FOR OTHER REACTIONS,
  ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING FROM OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

              DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
         ----------------------  ------------  ---------------
        V  = 50.01-0.5528E        R0 = 5.972    A0 = 0.56
        WS = 8.165                RS = 6.594    AS = 0.44
        VSO= 5.261                RSO= 5.97     ASO= 0.267
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2  LEVEL DENSITY PARAMETERS

 NUCLIDE   SYST A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
 ---------------------------------------------------------------
 46-PD-112  *   1.821E+01 6.210E-01 5.620E-01 7.654E+00 2.670E+00
 46-PD-113  *   1.800E+01 6.185E-01 4.082E+00 6.206E+00 1.350E+00
 46-PD-114  *   1.779E+01 6.161E-01 5.463E-01 7.226E+00 2.500E+00
 46-PD-115  *   1.758E+01 6.137E-01 3.052E+00 5.945E+00 1.350E+00

 47-AG-113  *   1.837E+01 6.185E-01 5.132E+00 6.321E+00 1.320E+00
 47-AG-114  *   1.816E+01 6.161E-01 3.785E+01 4.871E+00 0.0
 47-AG-115  *   1.795E+01 6.137E-01 5.063E+00 5.891E+00 1.150E+00
 47-AG-116  *   1.773E+01 6.113E-01 2.869E+01 4.609E+00 0.0

 48-CD-114      1.910E+01 6.010E-01 5.651E-01 7.611E+00 2.680E+00
 48-CD-115      2.072E+01 5.570E-01 4.805E+00 5.966E+00 1.360E+00
 48-CD-116      1.990E+01 5.750E-01 6.265E-01 7.206E+00 2.510E+00
 48-CD-117      2.107E+01 5.620E-01 6.164E+00 6.181E+00 1.360E+00
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  SYST:  * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

 SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
 IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
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ASSUMED TO BE 3.925 FOR CD-116 AND 5.0 FOR CD-117.

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MAT number = 4925

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 49-IN-113 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 830 EV
    RESONANCE PARAMETERS WERE BASED ON MUGHABGHAB ET AL./2/
    TOTAL SPIN J OF SOME RESONANCES WAS TENTATIVELY ESTIMATED WITH
    A RANDOM NUMBER METHOD.  NEUTRON ORBITAL ANGULAR MOMENTUM L OF
    SOME RESONANCES WAS ESTIMATED WITH A METHOD OF BOLLINGER AND
    THOMAS/3/.  AVERAGED RADIATION WIDTH AND SCATTERING RADIUS
    WERE TAKEN FROM MUGHABGHAB ET AL.

  UNRESOLVED RESONANCE REGION : 830 EV - 100 KEV
    THE NEUTRON STRENGTH FUNCTION, S0, WAS BASED ON MUGHABGHAB ET
    AL., AND S1 AND S2 WERE CALCULATED WITH OPTICAL MODEL CODE
    CASTHY/4/.  THE OBSERVED LEVEL SPACING AND S0 WERE ADJUSTED
    TO REPRODUCE THE CAPTURE AND TOTAL CROSS SECTIONS CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH GG WAS BASED ON THE COMPILATION OF
    MUGHABGHAB ET AL.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.840E-4, S1 = 2.700E-4, S2 = 0.770E-4, SG = 126.E-4,
    GG = 0.075 EV, R  = 5.496 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL          15.75                    -
      ELASTIC         3.679                   -
      CAPTURE        12.07                  325


MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/5/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING RSO OF IIJIMA-KAWAI POTENTIAL/6/.  THE
  OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/7/
     ALPHA    = HUIZENGA AND IGO/8/
     DEUTERON = LOHR AND HAEBERLI/9/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/10/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/11/ WERE EVALUATED BY IIJIMA ET AL./12/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /13/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/14/ AND NUCLEAR DATA
    SHEETS/15/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0            9/2 +
            1        0.3917         1/2 -
            2        0.6468         3/2 -
            3        1.0242         5/2 +
            4        1.0297         1/2 +
            5        1.0642         3/2 +
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               6         1.1064          5/2 -
               7         1.1315          5/2 +
               8         1.1731         11/2 +
               9         1.1911          7/2 +
              10         1.3448         13/2 +
              11         1.3510         13/2 +
              12         1.3807          1/2 -
              13         1.4718          3/2 -
              14         1.5094          7/2 +
              15         1.5361          1/2 -
              16         1.5670          9/2 +
              17         1.5695          1/2 -
              18         1.6305          9/2 +
              19         1.6882          9/2 +
              20         1.7000          1/2 +
              21         1.7070          1/2 +
              22         1.7580          9/2 +
              23         1.7680          3/2 +
              24         1.8227          1/2 +
         LEVELS ABOVE 1.836 MEV WERE ASSUMED TO BE OVERLAPPING.

     MT = 102  CAPTURE
       SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
       CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
       SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
       AND REFFO/16/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

       THE GAMMA-RAY STRENGTH FUNCTION (125.E-04) WAS ADJUSTED TO
       REPRODUCE THE CAPTURE CROSS SECTION OF 290 MILLI-BARNS AT 500
       KEV MEASURED BY GRENCH AND MENLOVE/17/.

     MT = 16  (N,2N) CROSS SECTION
     MT = 17  (N,3N) CROSS SECTION
     MT = 22  (N,N'A) CROSS SECTION
     MT = 28  (N,N'P) CROSS SECTION
     MT = 32  (N,N'D) CROSS SECTION
     MT = 33  (N,N'T) CROSS SECTION
     MT =103  (N,P) CROSS SECTION
     MT =104  (N,D) CROSS SECTION
     MT =105  (N,T) CROSS SECTION
     MT =106  (N,HE3) CROSS SECTION
     MT =107  (N,ALPHA) CROSS SECTION
       THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
       PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

       THE KALBACH'S CONSTANT K (= 151.6) WAS ESTIMATED BY THE
       FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/18/ AND LEVEL
       DENSITY PARAMETERS.

       FINALLY, THE (N,2N), (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
       NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
         (N,2N)      1600.00  MB (RECOMMENDED BY BYCHKOV+/19/)
         (N,P)         24.50  MB (SYSTEMATICS OF FORREST/20/)
         (N,ALPHA)      4.99  MB (SYSTEMATICS OF FORREST)

     MT = 251  MU-BAR
       CALCULATED WITH CASTHY/4/.

   MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
     LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
     GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
     TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
     CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
     BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

   MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
     ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
     PEGASUS FOR INELASTIC SCATTERING FROM OVERLAPPING LEVELS AND FOR
     OTHER NEUTRON EMITTING REACTIONS.

   TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                    DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
             ----------------------   ------------  ---------------
           V  = 47.64-0.473E          R0 = 6.256    A0 = 0.62
           WS = 9.744                 RS = 6.469    AS = 0.35
           VSO= 7.0                   RSO= 6.241    ASO= 0.62
     THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

   TABLE 2  LEVEL DENSITY PARAMETERS

    NUCLIDE   SYST A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
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47-AG-109		1.650E+01	6.300E-01	2.761E+00	5.709E+00	1.250E+00
47-AG-110		1.791E+01	5.900E-01	2.444E+01	4.282E+00	0.0
47-AG-111		1.955E+01	5.810E-01	6.505E+00	5.835E+00	1.140E+00
47-AG-112	*	1.857E+01	6.210E-01	4.959E+01	5.129E+00	0.0
48-CD-110		1.750E+01	6.300E-01	5.212E-01	7.482E+00	2.610E+00
48-CD-111		1.874E+01	5.930E-01	3.762E+00	6.000E+00	1.360E+00
48-CD-112		1.797E+01	6.190E-01	6.327E-01	7.351E+00	2.500E+00
48-CD-113		1.973E+01	5.760E-01	4.397E+00	6.018E+00	1.360E+00
49-IN-111	*	1.948E+01	6.234E-01	1.096E+01	6.793E+00	1.250E+00
49-IN-112		1.743E+01	5.090E-01	7.808E+00	2.779E+00	0.0
49-IN-113		1.885E+01	5.070E-01	1.371E+00	4.280E+00	1.140E+00
49-IN-114		1.632E+01	5.290E-01	6.292E+00	2.752E+00	0.0

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 6.604 FOR IN-113 AND 5.0 FOR IN-114.

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MAT number = 4931

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 49-IN-115 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-SEP90 REV2-MAR93
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.
93-03 JENDL-3.2 WAS MADE BY JNDC FPND W.G.

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)       UNRESOLVED RESONANCE PARAMETERS RE-ADJUSTED
                    SO AS TO REPRODUCE THE RE-NORMALIZED CAPTURE
                    CROSS SECTION.
      (3,102)       RE-NORMALIZATION.
      (3,2), (3,4), (3,51-91) AND ANGULAR DISTRIBUTIONS
                    SMALL EFFECTS OF THE RE-NORMALIZATION OF
                    CAPTURE CROSS SECTION.
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MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 2 KEV
    RESONANCE PARAMETERS OF JENDL-2 WERE MODIFIED AS FOLLOWS:
       FOR JENDL-2, PARAMETERS WERE TAKEN FROM THE EXPERIMENT BY
    HACKEN ET AL./3/  ANGULAR MOMENTUM L AND SPIN J WERE BASED ON
    THE MEASUREMENT OF CORVI AND STEFANON/4/.  THE AVERAGE
    RADIATION WIDTH OF 0.085 EV WAS DEDUCED /3/ AND APPLIED TO THE
    LEVELS WHOSE RADIATION WIDTH WAS UNKNOWN.
       FOR JENDL-3, TOTAL SPIN J OF SOME RESONANCES WAS TENTATIVE-
    LY ESTIMATED WITH A RANDOM NUMBER METHOD.

  UNRESOLVED RESONANCE REGION : 2 KEV - 100 KEV
    PARAMETERS WERE TAKEN FROM JENDL-2.
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/5/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.  THE RADIATION WIDTH GG WAS BASED ON THE COMPILATION
    OF MUGHABGHAB ET AL./6/

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.760E-4, S1 = 2.700E-4, S2 = 0.760E-4, SG = 95.0E-4,
    GG = 0.077 EV, R  = 5.539 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL         203.5                       -
      ELASTIC         2.526                     -
      CAPTURE       201.0                     3210

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/7/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING RSO OF IIJIMA-KAWAI POTENTIAL/8/.  THE OMP'S
  FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/9/
     ALPHA    = HUIZENGA AND IGO/10/
     DEUTERON = LOHR AND HAEBERLI/11/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/12/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/13/ WERE EVALUATED BY IIJIMA ET AL./14/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /15/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).
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MT = 4, 51 - 91 INELASTIC SCATTERING
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS ADOPTED. THE LEVEL SCHEME WAS TAKEN FROM REF./16/.

NO.	ENERGY(MEV)	SPIN-PARITY
GR.	0.0	9/2 +
1	0.3362	1/2 -
2	0.5970	3/2 -
3	0.8284	3/2 +
4	0.8640	1/2 +
5	0.9336	7/2 +
6	0.9412	5/2 +
7	1.0780	5/2 +
8	1.1325	11/2 +
9	1.2905	13/2 +
10	1.4180	9/2 +
11	1.4487	9/2 +
12	1.4625	7/2 +
13	1.4858	9/2 +

LEVELS ABOVE 1.5 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/17/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (9.37E-03) WAS ADJUSTED TO REPRODUCE THE NATURAL IN CAPTURE CROSS SECTION OF 460 MILLI-BARNS AT 80 KEV MEASURED BY KOMPE /18/, SHORIN ET AL./19/ AND KONONOV ET AL./20/

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT = 32 (N,N'D) CROSS SECTION
MT = 33 (N,N'T) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 138.9) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/21/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
(N,P)   8.00 MB (RECOMMENDED BY FORREST/22/)
(N,ALPHA)   2.40 MB (RECOMMENDED BY FORREST)
THE (N,2N) CROSS SECTION WAS DETERMINED BY EYE-GUIDING OF THE DATA MEASURED BY SANTRY ET AL./23/

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 47.64-0.473E	R0 = 6.256	A0 = 0.62
WS = 9.744	RS = 6.469	AS = 0.35
VSO= 7.0	RSO= 6.241	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
47-AG-111		1.955E+01	5.810E-01	6.505E+00	5.835E+00	1.140E+00
47-AG-112	*	1.857E+01	6.210E-01	4.959E+01	5.129E+00	0.0
47-AG-113	*	1.837E+01	6.185E-01	5.132E+00	6.321E+00	1.320E+00
47-AG-114	*	1.816E+01	6.161E-01	3.785E+01	4.871E+00	0.0
48-CD-112		1.797E+01	6.190E-01	6.327E-01	7.351E+00	2.500E+00
48-CD-113		1.973E+01	5.760E-01	4.397E+00	6.018E+00	1.360E+00
48-CD-114		1.910E+01	6.010E-01	5.651E-01	7.611E+00	2.680E+00
48-CD-115		2.072E+01	5.570E-01	4.805E+00	5.966E+00	1.360E+00
49-IN-113		1.885E+01	5.070E-01	1.371E+00	4.280E+00	1.140E+00
49-IN-114		1.632E+01	5.290E-01	6.292E+00	2.752E+00	0.0
49-IN-115		1.600E+01	6.510E-01	2.555E+00	5.941E+00	1.320E+00
49-IN-116		1.710E+01	5.650E-01	1.250E+01	3.562E+00	0.0

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 8.461 FOR IN-115 AND 5.0 FOR IN-116.

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MAT number = 5025

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 50-SN-112 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 1.5 KEV
    RESONANCE PARAMETERS WERE BASED ON MUGHABGHAB ET AL./2/
    NEUTRON ORBITAL ANGULAR MOMENTUM L OF SOME RESONANCES WAS
    ESTIMATED WITH A METHOD OF BOLLINGER AND THOMAS/3/.  AVERAGE
    RADIATION WIDTH WAS 110 MEV/2/.  SCATTERING RADIUS OF 6.3 FM
    WAS ASSUMED FROM THE SYSTEMATICS OF MEASURED VALUES FOR
    NEIGHBORING NUCLIDES.  A NEGATIVE RESONANCE WAS ADDED SO AS TO
    REPRODUCE THE THERMAL CAPTURE CROSS SECTION GIVEN BY
    MUGHABGHAB ET AL.

  UNRESOLVED RESONANCE REGION : 1.5 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTION S0 WAS BASED ON THE COMPILATION
    OF MUGHABGHAB ET AL., AND S1 AND S2 WERE CALCULATED WITH
    OPTICAL MODEL CODE CASTHY/4/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS OF
    MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.300E-4, S1 = 2.700E-4, S2 = 0.780E-4, SG = 4.11E-4,
    GG = 0.110 EV, R  = 5.896 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S                RES. INTEG.
      TOTAL           5.597                    -
      ELASTIC         4.588                    -
      CAPTURE         1.009                   30.5

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY/4/, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/5/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING RSO OF IIJIMA-KAWAI POTENTIAL/6/.  THE OMP'S
  FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/7/
     ALPHA    = HUIZENGA AND IGO/8/
     DEUTERON = LOHR AND HAEBERLI/9/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/10/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/11/ WERE EVALUATED BY IIJIMA ET AL./12/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /13/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/14/ AND NUCLEAR DATA
    SHEETS/15/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             0  +
            1        1.2570          2  +
            2        2.1513          2  +
            3        2.1909          0  +
            4        2.2479          4  +
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          5        2.3550          3  -
          6        2.4762          2  +
          7        2.5214          4  +
          8        2.5489          6  +
          9        2.5500          7  -
         10        2.5566          2  +
         11        2.6180          2  +
         12        2.7217          2  +
         13        2.7846          4  +
         14        2.9136          4  +
         15        2.9264          6  +
         16        2.9460          4  +
         17        2.9671          2  +
         18        3.0933          2  +
         19        3.1497          4  +
         20        3.2485          2  +
         21        3.2530          2  +
         22        3.2780          4  +
         23        3.2865          2  +
     LEVELS ABOVE 3.292 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/16/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (3.79E-04) WAS ADJUSTED TO
    REPRODUCE THE CAPTURE CROSS SECTION OF 220 MILLI-BARNS AT 25
    KEV MEASURED BY BRADLEY ET AL./17/

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =106  (N,HE3) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
  MT =111  (N,2P) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (= 146.9) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/18/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,2N), (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,2N)      1200.00  MB (RECOMMENDED BY BYCHKOV+/19/)
      (N,P)         30.00  MB (RECOMMENDED BY FORREST/20/)
      (N,ALPHA)     13.90  MB (SYSTEMATICS OF FORREST)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
         ----------------------   ------------  ---------------
        V  = 47.64-0.473E         R0 = 6.256    A0 = 0.62
        WS = 9.744                RS = 6.469    AS = 0.35
        VSO= 7.0                  RSO= 6.241    ASO= 0.62
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2  LEVEL DENSITY PARAMETERS

 NUCLIDE  SYST A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
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48-CD-108		1.541E+01	6.900E-01	5.114E-01	7.655E+00	2.600E+00
48-CD-109		1.812E+01	6.120E-01	3.856E+00	6.132E+00	1.360E+00
48-CD-110		1.750E+01	6.300E-01	5.212E-01	7.482E+00	2.610E+00
48-CD-111		1.874E+01	5.930E-01	3.762E+00	6.000E+00	1.360E+00
49-IN-109	*	1.984E+01	6.282E-01	1.463E+01	7.031E+00	1.240E+00
49-IN-110	*	1.966E+01	6.258E-01	9.269E+01	5.668E+00	0.0
49-IN-111	*	1.948E+01	6.234E-01	1.096E+01	6.793E+00	1.250E+00
49-IN-112		1.743E+01	5.090E-01	7.808E+00	2.779E+00	0.0
50-SN-110	*	2.002E+01	6.258E-01	2.291E+00	8.241E+00	2.430E+00
50-SN-111		1.496E+01	6.610E-01	2.129E+00	5.516E+00	1.190E+00
50-SN-112		1.463E+01	6.680E-01	3.016E-01	6.730E+00	2.440E+00
50-SN-113		1.635E+01	5.980E-01	1.778E+00	5.033E+00	1.190E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 7.907 FOR SN-112 AND 5.0 FOR SN-113.

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MAT number = 5031
 50-SN-114 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 2.5 KEV
    RESONANCE PARAMETERS WERE MAINLY BASED ON MUGHABGHAB ET AL./2/
    THE LEVELS WHOSE NEUTRON WIDTH WAS UNKNOWN WERE ASSUMED TO BE
    P-WAVE RESONANCES, AND A REDUCED NEUTRON WIDTH OF 0.082 EV WAS
    TENTATIVELY GIVEN FOR THOSE LEVELS.  AVERAGE RADIATION WIDTH
    OF 0.090 EV AND SCATTERING RADIUS OF 6.3 FM WERE TAKEN FROM
    MUGHABGHAB ET AL.

  UNRESOLVED RESONANCE REGION : 2.5 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTION S0 WAS BASED ON THE COMPILATION
    OF MUGHABGHAB ET AL., AND S1 AND S2 WERE CALCULATED WITH
    OPTICAL MODEL CODE CASTHY/3/.  THE OBSERVED LEVEL SPACING WERE
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH GG WAS BASED ON THE COMPILATION OF
    MUGHABGHAB ET AL.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.200E-4, S1 = 2.700E-4, S2 = 0.760E-4, SG = 3.00E-4,
    GG = 0.090 EV, R  = 5.953 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S              RES. INTEG.
      TOTAL           4.671                    -
      ELASTIC         4.546                    -
      CAPTURE         0.1253                    6.67

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/4/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING RSO OF IIJIMA-KAWAI POTENTIAL/5/.  THE
  OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/6/
     ALPHA    = HUIZENGA AND IGO/7/
     DEUTERON = LOHR AND HAEBERLI/8/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/9/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/10/ WERE EVALUATED BY IIJIMA ET AL./11/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /12/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/13/ AND NUCLEAR DATA
    SHEETS/14/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             0  +
            1        1.2999          2  +
            2        1.9532          0  +
            3        2.1550          0  +
            4        2.1875          4  +
            5        2.2392          2  +
            6        2.2747          3  -
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7	2.4220	0	+
8	2.4543	2	+
9	2.5147	2	+
10	2.5760	2	+
11	2.6143	4	+
12	2.7656	2	+
13	2.8151	5	-
14	2.8599	4	+
15	2.9051	2	+
16	2.9140	2	+
17	2.9435	2	+
18	3.0270	0	+
19	3.0874	7	-
20	3.1480	6	+
21	3.1840	2	+
22	3.1884	6	+
23	3.1903	8	-
24	3.2040	0	+
25	3.2078	2	+
26	3.2259	2	+

LEVELS ABOVE 3.244 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/15/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (2.71E-04) WAS DETERMINED FROM THE RADIATION WIDTH (0.09+-0.03 EV/2/) AND THE AVERAGE S-WAVE RESONANCE LEVEL SPACING (330 EV) CALCULATED FROM THE LEVEL DENSITY PARAMETERS.

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =106 (N,HE3) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 175.9) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/16/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,P)	38.50 MB	(SYSTEMATICS OF FORREST/17/)
(N,ALPHA)	7.55 MB	(SYSTEMATICS OF FORREST)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 47.64-0.473E	R0 = 6.256	A0 = 0.62
WS = 9.744	RS = 6.469	AS = 0.35
VSO= 7.0	RSO= 6.241	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING

48-CD-110		1.750E+01	6.300E-01	5.212E-01	7.482E+00	2.610E+00
48-CD-111		1.874E+01	5.930E-01	3.762E+00	6.000E+00	1.360E+00
48-CD-112		1.797E+01	6.190E-01	6.327E-01	7.351E+00	2.500E+00
48-CD-113		1.973E+01	5.760E-01	4.397E+00	6.018E+00	1.360E+00
49-IN-111	*	1.948E+01	6.234E-01	1.096E+01	6.793E+00	1.250E+00
49-IN-112		1.743E+01	5.090E-01	7.808E+00	2.779E+00	0.0
49-IN-113		1.885E+01	5.070E-01	1.371E+00	4.280E+00	1.140E+00
49-IN-114		1.632E+01	5.290E-01	6.292E+00	2.752E+00	0.0
50-SN-112		1.463E+01	6.680E-01	3.016E-01	6.730E+00	2.440E+00
50-SN-113		1.635E+01	5.980E-01	1.778E+00	5.033E+00	1.190E+00
50-SN-114		1.515E+01	6.270E-01	2.438E-01	6.175E+00	2.330E+00
50-SN-115		1.567E+01	5.540E-01	7.229E-01	4.100E+00	1.190E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 7.548 FOR SN-114 AND 7.437 FOR SN-115.

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MAT number = 5034

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 50-SN-115 JNDC        EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                       DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 0.95 KEV
    RESONANCE PARAMETERS WERE BASED ON MUGHABGHAB ET AL./2/  TOTAL
    SPIN J OF SOME RESONANCES WAS TENTATIVELY ESTIMATED WITH A
    RANDOM NUMBER METHOD.  AVERAGED RADIATION WIDTH OF 85 MEV AND
    SCATTERING RADIUS OF 6.3 FM WERE ASSUMED FROM THE SYSTEMATICS
    OF MEASURED VALUES FOR NEIGHBORING NUCLIDES.  A NEGATIVE
    RESONANCE WAS ADDED SO AS TO REPRODUCE THERMAL CAPTURE CROSS
    SECTION GIVEN BY MUGHABGHAB ET AL.

  UNRESOLVED RESONANCE REGION : 0.95 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTION S0 WAS BASED ON THE COMPILATION
    OF MUGHABGHAB ET AL./2/, AND S1 AND S2 WERE CALCULATED WITH
    OPTICAL MODEL CODE CASTHY/3/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS OF
    MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.300E-4, S1 = 2.700E-4, S2 = 0.750E-4, SG = 22.6E-4,
    GG = 0.085 EV, R  = 5.873 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL         38.22                     -
      ELASTIC        8.370                    -
      CAPTURE       29.85                   13.8

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/4/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING RSO OF IIJIMA-KAWAI POTENTIAL/5/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/6/
     ALPHA    = HUIZENGA AND IGO/7/
     DEUTERON = LOHR AND HAEBERLI/8/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/9/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/10/ WERE EVALUATED BY IIJIMA ET AL./11/.  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /12/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/13/ AND NUCLEAR DATA
    SHEETS/14/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             1/2 +
            1        0.4973          3/2 +
            2        0.6128          7/2 +
            3        0.7134         11/2 -
            4        0.9865          5/2 +
            5        1.2801          3/2 +
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6	1.4168	5/2 +
7	1.6338	3/2 +
8	1.7339	5/2 +
9	1.7856	7/2 -
10	1.8250	3/2 +
11	1.8575	7/2 +
12	1.9440	11/2 -
13	1.9640	1/2 +
14	1.9738	1/2 +
15	2.0246	15/2 -
16	2.0601	5/2 +

LEVELS ABOVE 2.084 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/15/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (20.9E-4) WAS ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION OF 200 MILLI-BARNS AT 100 KEV MEASURED BY TIMOKHOV ET AL./16/

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT = 32 (N,N'D) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =106 (N,HE3) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 194.4) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/17/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,P)	28.00 MB	(SYSTEMATICS OF FORREST/18/)
(N,ALPHA)	5.49 MB	(SYSTEMATICS OF FORREST)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 47.64-0.473E	R0 = 6.256	A0 = 0.62
WS = 9.744	RS = 6.469	AS = 0.35
VSO= 7.0	RSO= 6.241	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
48-CD-111	1.874E+01	5.930E-01	3.762E+00	6.000E+00	1.360E+00
48-CD-112	1.797E+01	6.190E-01	6.327E-01	7.351E+00	2.500E+00
48-CD-113	1.973E+01	5.760E-01	4.397E+00	6.018E+00	1.360E+00
48-CD-114	1.910E+01	6.010E-01	5.651E-01	7.611E+00	2.680E+00
49-IN-112	1.743E+01	5.090E-01	7.808E+00	2.779E+00	0.0
49-IN-113	1.885E+01	5.070E-01	1.371E+00	4.280E+00	1.140E+00
49-IN-114	1.632E+01	5.290E-01	6.292E+00	2.752E+00	0.0
49-IN-115	1.600E+01	6.510E-01	2.555E+00	5.941E+00	1.320E+00

50-SN-113	1.635E+01	5.980E-01	1.778E+00	5.033E+00	1.190E+00
50-SN-114	1.515E+01	6.270E-01	2.438E-01	6.175E+00	2.330E+00
50-SN-115	1.567E+01	5.540E-01	7.229E-01	4.100E+00	1.190E+00
50-SN-116	1.529E+01	6.680E-01	3.763E-01	7.111E+00	2.510E+00

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 7.437 FOR SN-115 AND 6.125 FOR SN-116.

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MAT number = 5037

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 50-SN-116 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 2 KEV
    RESONANCE PARAMETERS AND SCATTERING RADIUS WERE BASED ON
    MUGHABGHAB ET AL./2/  THE LEVEL AT 779 EV WHOSE NEUTRON WIDTH
    WAS UNKNOWN WAS ASSUMED TO BE A P-WAVE RESONANCE, AND A
    REDUCED NEUTRON WIDTH OF 160 MEV WAS TENTATIVELY GIVEN FOR
    THIS LEVEL.  NEUTRON ORBITAL ANGULAR MOMENTUM L OF SOME
    RESONANCES WAS ESTIMATED WITH A METHOD OF BOLLINGER AND THOMAS
    /3/.  AVERAGE RADIATION WIDTH OF 80 MEV WAS ASSUMED FROM THE
    SYSTEMATICS OF MEASURED VALUES FOR NEIGHBORING NUCLEI.

  UNRESOLVED RESONANCE REGION : 2 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/4/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.  THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS
    OF MEASURED GG FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.740E-4, S1 = 2.700E-4, S2 = 0.740E-4, SG = 1.79E-4,
    GG = 0.080 EV, R  = 5.567 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           4.439                    -
      ELASTIC         4.312                    -
      CAPTURE         0.1277                  12.4

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/5/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING RSO OF IIJIMA-KAWAI POTENTIAL/6/.  THE OMP'S
  FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/7/
     ALPHA    = HUIZENGA AND IGO/8/
     DEUTERON = LOHR AND HAEBERLI/9/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/10/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/11/ WERE EVALUATED BY IIJIMA ET AL./12/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /13/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/14/ AND NUCLEAR DATA
    SHEETS /15/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0              0  +
            1        1.2935           2  +
            2        1.7568           0  +
            3        2.0273           0  +
            4        2.1123           2  +
            5        2.2253           2  +
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            6        2.2661          3  -
            7        2.3659          5  -
            8        2.3908          4  +
            9        2.3922          4  +
           10        2.5291          4  +
      LEVELS ABOVE 2.546 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/16/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (1.66E-04) WAS ADJUSTED TO
    REPRODUCE THE CAPTURE CROSS SECTION OF 85 MILLI-BARNS AT 40
    KEV MEASURED BY MACKLIN AND GIBBONS/17/

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (= 179.7) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/18/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,P)          20.40  MB (SYSTEMATICS OF FORREST/19/)
      (N,ALPHA)       3.95  MB (SYSTEMATICS OF FORREST)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
          ----------------------  ------------  ---------------
        V  = 47.64-0.473E         R0 = 6.256    A0 = 0.62
        WS = 9.744                RS = 6.469    AS = 0.35
        VSO= 7.0                  RSO= 6.241    ASO= 0.62
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2  LEVEL DENSITY PARAMETERS

 NUCLIDE       A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)    PAIRING
 ---------------------------------------------------------------
 48-CD-112     1.797E+01 6.190E-01 6.327E-01 7.351E+00 2.500E+00
 48-CD-113     1.973E+01 5.760E-01 4.397E+00 6.018E+00 1.360E+00
 48-CD-114     1.910E+01 6.010E-01 5.651E-01 7.611E+00 2.680E+00
 48-CD-115     2.072E+01 5.570E-01 4.805E+00 5.966E+00 1.360E+00

 49-IN-113     1.885E+01 5.070E-01 1.371E+00 4.280E+00 1.140E+00
 49-IN-114     1.632E+01 5.290E-01 6.292E+00 2.752E+00 0.0
 49-IN-115     1.600E+01 6.510E-01 2.555E+00 5.941E+00 1.320E+00
 49-IN-116     1.710E+01 5.650E-01 1.250E+01 3.562E+00 0.0

 50-SN-114     1.515E+01 6.270E-01 2.438E-01 6.175E+00 2.330E+00
 50-SN-115     1.567E+01 5.540E-01 7.229E-01 4.100E+00 1.190E+00
 50-SN-116     1.529E+01 6.680E-01 3.763E-01 7.111E+00 2.510E+00
 50-SN-117     1.583E+01 5.960E-01 1.352E+00 4.804E+00 1.190E+00
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 SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
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IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 6.125 FOR SN-116 AND 5.375 FOR SN-117.

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MAT number = 5040
 50-SN-117 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-SEP90 REV2-MAR93
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/
93-03 JENDL-3.2 WAS MADE BY JNDC FPND W.G.

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)       UNRESOLVED RESONANCE PARAMETERS RE-ADJUSTED
                    SO AS TO REPRODUCE THE RE-NORMALIZED CAPTURE
                    CROSS SECTION.
      (3,102)       RE-NORMALIZATION.
      (3,2), (3,4), (3,51-91) AND ANGULAR DISRIBUTIONS
                    SMALL EFFECTS OF THE RE-NORMALIZATION OF
                    CAPTURE CROSS SECTION.
     ***********************************************************


MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 2.35 KEV
    RESONANCE PARAMETERS WERE MAINLY BASED ON MUGHABGHAB ET AL.
    /2/ NEW DATA MEASURED BY ALFIMENKOV ET AL./3/ WERE ALSO
    CONSIDERED.  TOTAL SPIN J OF SOME RESONANCES WAS TENTATIVELY
    ESTIMATED WITH A RANDOM NUMBER METHOD.  NEUTRON ORBITAL
    ANGULAR MOMENTUM L OF SOME RESONANCES WAS ESTIMATED WITH A
    METHOD OF BOLLINGER AND THOMAS/4/.  AVERAGED RADIATION WIDTH
    OF 74 MEV WAS DEDUCED AND APPLIED TO THE LEVELS WHOSE RADIA-
    TION WIDTH WAS UNKNOWN.  SCATTERING RADIUS OF 6.1 FM WAS
    ASSUMED FROM THE SYSTEMATICS OF MEASURED VALUES FOR NEIGHBOR-
    ING NUCLIDES.  A NEGATIVE RESONANCE WAS ADDED SO AS TO
    REPRODUCE THE THERMAL CAPTURE AND SCATTERING CROSS SECTIONS
    GIVEN BY MUGHABGHAB ET AL.

  UNRESOLVED RESONANCE REGION : 2.35 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTION S1 WAS BASED ON THE COMPILATION
    OF MUGHABGHAB ET AL., AND S2 WAS CALCULATED WITH OPTICAL MODEL
    CODE CASTHY/5/.  THE OBSERVED LEVEL SPACING AND S0 WERE
    DETERMINED TO REPRODUCE THE CAPTURE AND TOTAL CROSS SECTIONS
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.  THE RADIATION WIDTH GG WAS BASED ON THE COMPILATION
    OF MUGHABGHAB ET AL.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.499E-4, S1 = 3.000E-4, S2 = 0.730E-4, SG = 15.6E-4,
    GG = 0.080 EV, R  = 5.582 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                        2200 M/S               RES. INTEG.
      TOTAL             7.277                     -
      ELASTIC           5.104                     -
      CAPTURE           2.173                    18.2

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/6/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING RSO OF IIJIMA-KAWAI POTENTIAL/7/.  THE OMP'S
  FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/8/
     ALPHA    = HUIZENGA AND IGO/9/
     DEUTERON = LOHR AND HAEBERLI/10/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/11/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/12/ WERE EVALUATED BY IIJIMA ET AL./13/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /14/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.
```

```
  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/15/ AND NUCLEAR DATA
    SHEETS /16/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             1/2 +
            1        0.1586          3/2 +
            2        0.3146         11/2 -
            3        0.7116          7/2 +
            4        1.0045          3/2 +
            5        1.0199          5/2 +
            6        1.1796          5/2 +
            7        1.3043          7/2 -
            8        1.4464          5/2 +
            9        1.4972          5/2 +
           10        1.5783          3/2 +
           11        1.6680          5/2 +
           12        1.7700          3/2 +
      LEVELS ABOVE 1.948 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/17/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (1.504E-3) WAS ADJUSTED TO
    REPRODUCE THE CAPTURE CROSS SECTION OF 167 MILLI-BARNS AT 90
    KEV MEASURED BY TIMOKHOV ET AL./18/.

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT = 32  (N,N'D) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (= 167.9) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/19/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,P)          14.00  MB (MEASURED BY IKEDA+/20/)
      (N,ALPHA)       2.82  MB (SYSTEMATICS OF FORREST/21/)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
         ----------------------  ------------  ---------------
        V  = 47.64-0.473E        R0 = 6.256    A0 = 0.62
        WS = 9.744               RS = 6.469    AS = 0.35
        VSO= 7.0                 RSO= 6.241    ASO= 0.62
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2  LEVEL DENSITY PARAMETERS
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NUCLIDE	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
48-CD-113	1.973E+01	5.760E-01	4.397E+00	6.018E+00	1.360E+00
48-CD-114	1.910E+01	6.010E-01	5.651E-01	7.611E+00	2.680E+00
48-CD-115	2.072E+01	5.570E-01	4.805E+00	5.966E+00	1.360E+00
48-CD-116	1.990E+01	5.750E-01	6.265E-01	7.206E+00	2.510E+00
49-IN-114	1.632E+01	5.290E-01	6.292E+00	2.752E+00	0.0
49-IN-115	1.600E+01	6.510E-01	2.555E+00	5.941E+00	1.320E+00
49-IN-116	1.710E+01	5.650E-01	1.250E+01	3.562E+00	0.0
49-IN-117	1.678E+01	6.010E-01	2.387E+00	5.208E+00	1.150E+00
50-SN-115	1.567E+01	5.540E-01	7.229E-01	4.100E+00	1.190E+00
50-SN-116	1.529E+01	6.680E-01	3.763E-01	7.111E+00	2.510E+00
50-SN-117	1.583E+01	5.960E-01	1.352E+00	4.804E+00	1.190E+00
50-SN-118	1.633E+01	6.140E-01	3.341E-01	6.448E+00	2.340E+00

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 5.375 FOR SN-117 AND 5.410 FOR SN-118.

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MAT number = 5043

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 50-SN-118 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 4.8 KEV
    RESONANCE PARAMETERS AND SCATTERING RADIUS WERE BASED ON
    MUGHABGHAB ET AL./2/  THE LEVELS WHOSE NEUTRON WIDTH WAS
    UNKNOWN WERE ASSUMED TO BE P-WAVE RESONANCES, AND A REDUCED
    NEUTRON WIDTH OF 250 MEV WAS TENTATIVELY GIVEN FOR THESE
    LEVELS.  NEUTRON ORBITAL ANGULAR MOMENTUM L OF SOME RESONANCES
    WAS ESTIMATED WITH A METHOD OF BOLLINGER AND THOMAS/3/.
    AVERAGE RADIATION WIDTH WAS ASSUMED TO BE 85 MEV ACCORDING TO
    THE SYSTEMATICS FROM THE NEIGHBORING NUCLIDES.  A NEGATIVE
    RESONANCE WAS ADDED SO AS TO REPRODUCE THE THERMAL CAPTURE AND
    SCATTERING CROSS SECTIONS GIVEN BY MUGHABGHAB ET AL.

  UNRESOLVED RESONANCE REGION : 4.8 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTION S0 WAS BASED ON THE COMPILATION
    OF MUGHABGHAB ET AL., AND S1 AND S2 WERE CALCULATED WITH
    OPTICAL MODEL CODE CASTHY/4/.  THE OBSERVED LEVEL SPACING WERE
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS OF
    MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.460E-4, S1 = 2.600E-4, S2 = 0.730E-4, SG = 0.976E-4,
    GG = 0.085 EV, R  = 5.803 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL          4.440                      -
      ELASTIC        4.222                      -
      CAPTURE        0.2178                     5.35

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/5/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING RSO OF IIJIMA-KAWAI POTENTIAL/6/.  THE OMP'S
  FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/7/
     ALPHA    = HUIZENGA AND IGO/8/
     DEUTERON = LOHR AND HAEBERLI/9/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/10/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/11/ WERE EVALUATED BY IIJIMA ET AL./12/.  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /13/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/14/ AND NUCLEAR DATA
    SHEETS/15/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             0  +
            1        1.2296          2  +
            2        1.7578          0  +
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          3         2.0431          2  +
          4         2.0565          0  +
          5         2.2803          4  +
          6         2.3100          3  -
          7         2.3211          5  -
    LEVELS ABOVE 2.326 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/16/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (8.96E-05) WAS ADJUSTED TO
    REPRODUCE THE CAPTURE CROSS SECTION OF 52 MILLI-BARNS AT 40
    KEV MEASURED BY MACKLIN AND GIBBONS/17/.

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (= 171.6) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/18/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,P) CROSS SECTION WAS NORMALIZED TO THE
    FOLLOWING VALUE AT 14.5 MEV:
      (N,P)          7.00  MB (RECOMMENDED BY FORREST/19/)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

              DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
         ----------------------  ------------  ---------------
       V  = 47.64-0.473E         R0 = 6.256    A0 = 0.62
       WS = 9.744                RS = 6.469    AS = 0.35
       VSO= 7.0                  RSO= 6.241    ASO= 0.62
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2  LEVEL DENSITY PARAMETERS

 NUCLIDE  SYST A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
 ---------------------------------------------------------------
 48-CD-114      1.910E+01 6.010E-01 5.651E-01 7.611E+00 2.680E+00
 48-CD-115      2.072E+01 5.570E-01 4.805E+00 5.966E+00 1.360E+00
 48-CD-116      1.990E+01 5.750E-01 6.265E-01 7.206E+00 2.510E+00
 48-CD-117      2.107E+01 5.620E-01 6.164E+00 6.181E+00 1.360E+00

 49-IN-115      1.600E+01 6.510E-01 2.555E+00 5.941E+00 1.320E+00
 49-IN-116      1.710E+01 5.650E-01 1.250E+01 3.562E+00 0.0
 49-IN-117      1.678E+01 6.010E-01 2.387E+00 5.208E+00 1.150E+00
 49-IN-118   *  1.804E+01 6.064E-01 3.111E+01 4.636E+00 0.0

 50-SN-116      1.529E+01 6.680E-01 3.763E-01 7.111E+00 2.510E+00
 50-SN-117      1.583E+01 5.960E-01 1.352E+00 4.804E+00 1.190E+00
 50-SN-118      1.633E+01 6.140E-01 3.341E-01 6.448E+00 2.340E+00
 50-SN-119      1.635E+01 5.990E-01 1.772E+00 5.050E+00 1.190E+00
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  SYST:  * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

 SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
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IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 5.410 FOR SN-118 AND 3.524 FOR SN-119.

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MAT number = 5046

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 50-SN-119 JNDC        EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                       DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 1.3 KEV
    RESONANCE PARAMETERS WERE BASED ON MUGHABGHAB ET AL./2/ TOTAL
    SPIN J OF SOME RESONANCES WAS TENTATIVELY ESTIMATED WITH A
    RANDOM NUMBER METHOD.  NEUTRON ORBITAL ANGULAR MOMENTUM L OF
    SOME RESONANCES WAS ESTIMATED WITH A METHOD OF BOLLINGER AND
    THOMAS/3/.  AVERAGE RADIATION WIDTH OF 90 MEV AND SCATTERING
    RADIUS OF 6.0 FM WERE ASSUMED FROM THE SYSTEMATICS OF MEASURED
    VALUES FOR NEIGHBORING NUCLIDES.  A NEGATIVE RESONANCE WAS
    ADDED SO AS TO REPRODUCE THE THERMAL CAPTURE AND SCATTERING
    CROSS SECTIONS GIVEN BY MUGHABGHAB ET AL.

  UNRESOLVED RESONANCE REGION : 1.3 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTION S1 WAS BASED ON THE COMPILATION
    OF MUGHABGHAB ET AL., AND S0 AND S2 WERE CALCULATED WITH
    OPTICAL MODEL CODE CASTHY/4/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS OF
    MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.740E-4, S1 = 3.800E-4, S2 = 0.720E-4, SG = 12.7E-4,
    GG = 0.090 EV, R  = 4.970 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           6.852                   -
      ELASTIC         4.676                   -
      CAPTURE         2.176                    5.33

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/5/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING RSO OF IIJIMA-KAWAI POTENTIAL/6/.  THE OMP'S
  FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/7/
     ALPHA    = HUIZENGA AND IGO/8/
     DEUTERON = LOHR AND HAEBERLI/9/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/10/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/11/ WERE EVALUATED BY IIJIMA ET AL./12/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /13/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/14/ AND NUCLEAR DATA
    SHEETS/15/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             1/2 +
            1        0.0239          3/2 +
            2        0.0895         11/2 -
            3        0.7870          7/2 +
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          4         0.9205         3/2 +
          5         0.9214         5/2 +
          6         1.0624         7/2 -
          7         1.0894         5/2 +
          8         1.1877         3/2 +
          9         1.2497         1/2 +
         10         1.3549         5/2 +
         11         1.5544         3/2 +
         12         1.5716         3/2 +
         13         1.6173         1/2 +
         14         1.6310         3/2 +
         15         1.7184         3/2 +
         16         1.7747         5/2 -
         17         1.7897         1/2 -
         18         1.9050         3/2 +
         19         1.9296         1/2 -
         20         1.9388         1/2 -
     LEVELS ABOVE 1.983 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/16/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (12.9E-4) WAS ADJUSTED TO
    REPRODUCE THE CAPTURE CROSS SECTION OF 80 MILLI-BARNS AT 100
    KEV MEASURED BY TIMOKHOV ET AL./17/

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT = 32  (N,N'D) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (= 189.5) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/18/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,P)            5.50  MB (RECOMMENDED BY FORREST/19/)
      (N,ALPHA)        1.40  MB (SYSTEMATICS OF FORREST)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
         ----------------------   ------------  ---------------
        V  = 47.64-0.473E         R0 = 6.256    A0 = 0.62
        WS = 9.744                RS = 6.469    AS = 0.35
        VSO= 7.0                  RSO= 6.241    ASO= 0.62
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2  LEVEL DENSITY PARAMETERS

 NUCLIDE  SYST A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
 ---------------------------------------------------------------
 48-CD-115      2.072E+01 5.570E-01 4.805E+00 5.966E+00 1.360E+00
 48-CD-116      1.990E+01 5.750E-01 6.265E-01 7.206E+00 2.510E+00
 48-CD-117      2.107E+01 5.620E-01 6.164E+00 6.181E+00 1.360E+00
 48-CD-118   *  1.766E+01 6.064E-01 3.562E-01 7.089E+00 2.600E+00
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49-IN-116		1.710E+01	5.650E-01	1.250E+01	3.562E+00	0.0
49-IN-117		1.678E+01	6.010E-01	2.387E+00	5.208E+00	1.150E+00
49-IN-118	*	1.804E+01	6.064E-01	3.111E+01	4.636E+00	0.0
49-IN-119		1.940E+01	5.340E-01	2.195E+00	4.999E+00	1.240E+00
50-SN-117		1.583E+01	5.960E-01	1.352E+00	4.804E+00	1.190E+00
50-SN-118		1.633E+01	6.140E-01	3.341E-01	6.448E+00	2.340E+00
50-SN-119		1.635E+01	5.990E-01	1.772E+00	5.050E+00	1.190E+00
50-SN-120		1.595E+01	6.540E-01	4.691E-01	7.083E+00	2.430E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 3.524 FOR SN-119 AND 6.5 FOR SN-120.

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MAT number = 5049

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 50-SN-120 JNDC        EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                       DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 70 KEV
    RESONANCE PARAMETERS WERE BASED ON MUGHABGHAB ET AL./2/ TOTAL
    SPIN J OF J-UNKNOWN P-WAVE RESONANCES WAS ASSUMED TO BE 1/2.
    NEUTRON ORBITAL ANGULAR MOMENTUM L OF SOME RESONANCES WAS
    ESTIMATED WITH A METHOD OF BOLLINGER AND THOMAS/3/.  AVERAGE
    RADIATION WIDTH OF 120 MEV WAS DEDUCED AND APPLIED TO THE
    LEVELS WHOSE RADIATION WIDTH WAS UNKNOWN.  SCATTERING RADIUS
    OF 6.0 FM WAS ASSUMED FROM THE SYSTEMATICS OF MEASURED VALUES
    FOR NEIGHBORING NUCLIDES.  A NEGATIVE RESONANCE WAS ADDED SO
    AS TO REPRODUCE THE THERMAL CAPTURE AND SCATTERING CROSS
    SECTIONS GIVEN BY MUGHABGHAB ET AL.

  UNRESOLVED RESONANCE REGION : 70 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTION S0 AND S1 WERE BASED ON THE
    COMPILATION OF MUGHABGHAB ET AL., AND S2 WAS CALCULATED WITH
    OPTICAL MODEL CODE CASTHY/4/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS OF
    MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.140E-4, S1 = 2.100E-4, S2 = 0.710E-4, SG = 0.507E-4,
    GG = 0.120 EV, R  = 6.267 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                      2200 M/S               RES. INTEG.
      TOTAL           5.479                    -
      ELASTIC         5.340                    -
      CAPTURE         0.1392                    1.22

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/5/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING RSO OF IIJIMA-KAWAI POTENTIAL/6/.  THE OMP'S
  FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/7/
     ALPHA    = HUIZENGA AND IGO/8/
     DEUTERON = LOHR AND HAEBERLI/9/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/10/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/11/ WERE EVALUATED BY IIJIMA ET AL./12/.  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /13/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/14/ AND NUCLEAR DATA
    SHEETS/15/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0              0  +
            1        1.1715           2  +
            2        1.8750           0  +
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3	2.0975	2	+
4	2.1598	0	+
5	2.1946	4	+
6	2.2846	5	-
7	2.2900	0	+
8	2.3556	2	+
9	2.3997	3	-
10	2.4211	1	-
11	2.4661	4	+
12	2.4820	7	-
13	2.5868	0	+
14	2.6427	4	+
15	2.6972	4	+
16	2.7213	2	+

LEVELS ABOVE 2.76 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/16/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (0.455E-4) WAS ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION OF 21 MILLI-BARNS AT 100 KEV MEASURED BY TIMOKHOV ET AL./17/

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 182.1) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/18/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
(N,P) 4.50 MB (RECOMMENDED BY FORREST/19/)
(N,ALPHA) 0.40 MB (RECOMMENDED BY IKEDA+/20/)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 47.64-0.473E	R0 = 6.256	A0 = 0.62
WS = 9.744	RS = 6.469	AS = 0.35
VSO= 7.0	RSO= 6.241	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
48-CD-116		1.990E+01	5.750E-01	6.265E-01	7.206E+00	2.510E+00
48-CD-117		2.107E+01	5.620E-01	6.164E+00	6.181E+00	1.360E+00
48-CD-118	*	1.766E+01	6.064E-01	3.562E-01	7.089E+00	2.600E+00
48-CD-119	*	1.742E+01	6.040E-01	2.363E+00	5.715E+00	1.360E+00
49-IN-117		1.678E+01	6.010E-01	2.387E+00	5.208E+00	1.150E+00
49-IN-118	*	1.804E+01	6.064E-01	3.111E+01	4.636E+00	0.0
49-IN-119		1.940E+01	5.340E-01	2.195E+00	4.999E+00	1.240E+00

49-IN-120	*	1.757E+01	6.016E-01	2.330E+01	4.366E+00	0.0
50-SN-118		1.633E+01	6.140E-01	3.341E-01	6.448E+00	2.340E+00
50-SN-119		1.635E+01	5.990E-01	1.772E+00	5.050E+00	1.190E+00
50-SN-120		1.595E+01	6.540E-01	4.691E-01	7.083E+00	2.430E+00
50-SN-121		1.630E+01	6.100E-01	2.010E+00	5.217E+00	1.190E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 6.5 FOR SN-120 AND 5.0 FOR SN-121.

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MAT number = 5055

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 50-SN-122 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 29 KEV
    RESONANCE PARAMETERS WERE EVALUATED AS FOLLOWS:
    RESONANCE ENERGIES AND NEUTRON WIDTHS WERE BASED ON MAINLY THE
    DATA MEASURED BY NAKAJIMA ET AL./2/ AND PARTIALLY THOSE GIVEN
    BY MUGHABGHAB ET AL./3/  NEUTRON ORBITAL ANGULAR MOMENTUM L OF
    SOME RESONANCES WAS ESTIMATED WITH A METHOD OF BOLLINGER AND
    THOMAS/4/.  AVERAGED RADIATION WIDTH OF 130 MEV WAS ASSUMED
    FROM THE SYSTEMATICS OF MEASURED VALUES FOR NEIGHBORING
    NUCLIDES.  SCATTERING RADIUS WAS TAKEN AS 5.7 FM /3/.  A
    NEGATIVE RESONANCE WAS ADDED SO AS TO REPRODUCE THE THERMAL
    CAPTURE CROSS SECTION GIVEN BY MUGHABGHAB ET AL.

  UNRESOLVED RESONANCE REGION : 29 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/5/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.  THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS
    OF MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.740E-4, S1 = 2.600E-4, S2 = 0.700E-4, SG = 0.297E-4,
    GG = 0.130 EV, R  = 5.564 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           3.979                   -
      ELASTIC         3.795                   -
      CAPTURE         0.1837                   0.933

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/6/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING RSO OF IIJIMA-KAWAI POTENTIAL/7/.  THE OMP'S
  FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/8/
     ALPHA    = HUIZENGA AND IGO/9/
     DEUTERON = LOHR AND HAEBERLI/10/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/11/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/12/ WERE EVALUATED BY IIJIMA ET AL./13/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /14/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/15/ AND NUCLEAR DATA
    SHEETS/16/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             0  +
            1        1.1402          2  +
            2        2.0900          0  +
            3        2.1450          4  +
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4	2.1530	1	+
5	2.2490	5	-
6	2.3360	4	+
7	2.4000	7	-
8	2.4150	2	+
9	2.4920	3	-

LEVELS ABOVE 2.556 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/17/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (2.75E-5) WAS ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION OF 23 MILLI-BARNS AT 30 KEV MEASURED BY MACKLIN ET AL./18/

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 241.0) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/19/ AND LEVEL DENSITY PARAMETERS.

MT = 251 MU-BAR
CALCULATED WITH CASTHY/5/.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 47.64-0.473E	R0 = 6.256	A0 = 0.62
WS = 9.744	RS = 6.469	AS = 0.35
VSO= 7.0	RSO= 6.241	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
48-CD-118	*	1.766E+01	6.064E-01	3.562E-01	7.089E+00	2.600E+00
48-CD-119	*	1.742E+01	6.040E-01	2.363E+00	5.715E+00	1.360E+00
48-CD-120	*	1.718E+01	6.016E-01	1.880E-01	7.009E+00	2.790E+00
48-CD-121	*	1.693E+01	5.992E-01	1.734E+00	5.442E+00	1.360E+00
49-IN-119		1.940E+01	5.340E-01	2.195E+00	4.999E+00	1.240E+00
49-IN-120	*	1.757E+01	6.016E-01	2.330E+01	4.366E+00	0.0
49-IN-121		1.601E+01	6.060E-01	1.119E+00	5.277E+00	1.430E+00
49-IN-122	*	1.707E+01	5.968E-01	1.737E+01	4.092E+00	0.0
50-SN-120		1.595E+01	6.540E-01	4.691E-01	7.083E+00	2.430E+00
50-SN-121		1.630E+01	6.100E-01	2.010E+00	5.217E+00	1.190E+00
50-SN-122		1.434E+01	7.060E-01	3.423E-01	7.416E+00	2.620E+00
50-SN-123		1.509E+01	6.870E-01	3.062E+00	6.032E+00	1.190E+00

SYST: * = LDP'S WERE DETERMINED FORM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 8.569 FOR SN-122 AND 4.541 FOR SN-123.

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MAT number = 5058

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 50-SN-123 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  NO RESOLVED RESONANCE PARAMETERS

  UNRESOLVED RESONANCE REGION : 22 EV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/2/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.  THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS
    OF MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.740E-4, S1 = 2.600E-4, S2 = 0.690E-4, SG = 30.1E-4,
    GG = 0.140 EV, R  = 5.548 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           7.000                   -
      ELASTIC         4.000                   -
      CAPTURE         3.000                  62.6

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 22 EV, THE CAPTURE AND ELASTIC SCATTERING CROSS SECTIONS
  WERE ASSUMED TO BE IN 1/V FORM AND CONSTANT, RESPECTIVELY.  THE
  CAPTURE CROSS SECTION AT 0.0253 EV WAS DETERMINED BY THE
  SYSTEMATICS FROM NEIGHBORING SN ISOTOPES.  THE ELASTIC SCATTE-
  RING CROSS SECTION WAS ESTIMATED FROM R = 5.4 FM.  UNRESOLVED
  RESONANCE PARAMETERS WERE GIVEN IN THE ENERGY RANGE FROM 22 EV
  TO 100 KEV.

  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/3/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED SO AS TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL
  CROSS SECTION BY CHANGING RSO OF IIJIMA-KAWAI POTENTIAL/4/. THE
  OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/5/
     ALPHA    = HUIZENGA AND IGO/6/
     DEUTERON = LOHR AND HAEBERLI/7/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/8/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/9/ WERE EVALUATED BY IIJIMA ET AL./10/.  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /11/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/12/ AND NUCLEAR DATA
    SHEETS/13/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0           11/2 -
            1        0.0246         3/2 +
            2        0.1504         1/2 +
            3        0.6188         9/2 -
            4        0.8702         3/2 +
            5        0.8990         5/2 +
            6        0.9198         3/2 +
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7	0.9314	7/2 -
8	1.0443	7/2 +
9	1.0721	3/2 +
10	1.1359	1/2 +
11	1.1550	7/2 +
12	1.1944	5/2 +

LEVELS ABOVE 1.301 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/14/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (2.97E-03) WAS DETERMINED FROM THE SYSTEMATICS OF RADIATION WIDTH (0.13 EV) AND AVERAGE S-WAVE RESONANCE LEVEL SPACING (43.8 EV) OBTAINED FROM THE LEVEL DENSITY PARAMETERS.

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 206.8) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/15/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) CROSS SECTION WAS NORMALIZED TO THE FOLLOWING VALUE AT 14.5 MEV:
(N,P) 2.15 MB (SYSTEMATICS OF FORREST/16/)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 47.64-0.473E	R0 = 6.256	A0 = 0.62
WS = 9.744	RS = 6.469	AS = 0.35
VSO= 7.0	RSO= 6.241	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
48-CD-119	*	1.742E+01	6.040E-01	2.363E+00	5.715E+00	1.360E+00
48-CD-120	*	1.718E+01	6.016E-01	1.880E-01	7.009E+00	2.790E+00
48-CD-121	*	1.693E+01	5.992E-01	1.734E+00	5.442E+00	1.360E+00
48-CD-122	*	1.667E+01	5.968E-01	2.388E-01	6.394E+00	2.450E+00
49-IN-120	*	1.757E+01	6.016E-01	2.330E+01	4.366E+00	0.0
49-IN-121		1.601E+01	6.060E-01	1.119E+00	5.277E+00	1.430E+00
49-IN-122	*	1.707E+01	5.968E-01	1.737E+01	4.092E+00	0.0
49-IN-123		1.470E+01	6.100E-01	1.134E+00	4.483E+00	1.090E+00
50-SN-121		1.630E+01	6.100E-01	2.010E+00	5.217E+00	1.190E+00
50-SN-122		1.434E+01	7.060E-01	3.423E-01	7.416E+00	2.620E+00
50-SN-123		1.509E+01	6.870E-01	3.062E+00	6.032E+00	1.190E+00
50-SN-124		1.601E+01	6.160E-01	3.224E-01	6.294E+00	2.280E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 4.541 FOR SN-123 AND 7.975 FOR SN-124.

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MAT number = 5061
 50-SN-124 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-SEP90 REV2-MAR93
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/
93-03 JENDL-3.2 WAS MADE BY JNDC FPND W.G.

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)       UNRESOLVED RESONANCE PARAMETERS RE-ADJUSTED
                    SO AS TO REPRODUCE THE RE-NORMALIZED CAPTURE
                    CROSS SECTION.
      (3,102)       RE-NORMALIZATION.
      (3,2), (3,4), (3,51-91) AND ANGULAR DISTRIBUTIONS
                    SMALL EFFECTS OF THE RE-NORMALIZATION OF
                    CAPTURE CROSS SECTION.
     ***********************************************************


MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 10.7 KEV
    RESONANCE PARAMETERS AND SCATTERING RADIUS WERE BASED ON
    MUGHABGHAB ET AL./2/  THE LEVELS WHOSE NEUTRON WIDTH WAS
    UNKNOWN WERE ASSUMED TO BE P-WAVE RESONANCES, AND A REDUCED
    NEUTRON WIDTH OF 830 MEV WAS TENTATIVELY GIVEN FOR THESE
    LEVELS.  NEUTRON ORBITAL ANGULAR MOMENTUM L OF SOME RESONANCES
    WAS ESTIMATED WITH A METHOD OF BOLLINGER AND THOMAS/3/.
    AVERAGED RADIATION WIDTH OF 140 MEV WAS DERIVED FROM THE
    SYSTEMATICS OF MEASURED VALUES FOR NEIGHBORING NUCLIDES.  A
    NEGATIVE RESONANCE WAS ADDED SO AS TO REPRODUCE THE THERMAL
    CAPTURE AND ELASTIC SCATTERING CROSS SECTIONS GIVEN BY
    MUGHABGHAB ET AL.

  UNRESOLVED RESONANCE REGION : 10.7 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTION S0 WAS BASED ON THE COMPILATION
    OF MUGHABGHAB ET AL., AND S1 AND S2 WERE CALCULATED WITH
    OPTICAL MODEL CODE CASTHY/4/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS OF
    MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.150E-4, S1 = 2.600E-4, S2 = 0.680E-4, SG = 0.144E-4,
    GG = 0.140 EV, R  = 5.979 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           4.535                     -
      ELASTIC         4.400                     -
      CAPTURE         0.1355                     7.86

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/5/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED SO AS TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL
  CROSS SECTION BY CHANGING RSO OF IIJIMA-KAWAI POTENTIAL/6/. THE
  OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/7/
     ALPHA    = HUIZENGA AND IGO/8/
     DEUTERON = LOHR AND HAEBERLI/9/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/10/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/11/ WERE EVALUATED BY IIJIMA ET AL./12/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /13/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.
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   MT = 2  ELASTIC SCATTERING
     CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

   MT = 4, 51 - 91  INELASTIC SCATTERING
     SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
     ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
     STRUCTURE DATA FILE (1987 VERSION)/14/ AND NUCLEAR DATA
     SHEETS/15/.

            NO.      ENERGY(MEV)    SPIN-PARITY
            GR.       0.0              0  +
             1        1.1316           2  +
             2        2.1016           4  +
             3        2.1293           0  +
             4        2.1294           2  +
             5        2.1920           2  +
             6        2.2045           5  -
             7        2.2215           2  +
             8        2.3249           7  -
             9        2.3664           2  +
            10        2.4264           2  +
            11        2.4469           8  +
            12        2.5680           6  -
            13        2.6024           2  +
            14        2.6142           3  -
            15        2.6866           0  +
            16        2.6887           1  -
            17        2.7029           4  +
            18        2.8363           2  +
            19        2.8751           2  +
            20        2.8783           2  +
       LEVELS ABOVE 2.9 MEV WERE ASSUMED TO BE OVERLAPPING.

   MT = 102  CAPTURE
     SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
     CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
     SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
     AND REFFO/16/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

     THE GAMMA-RAY STRENGTH FUNCTION (0.1286-4) WAS ADJUSTED TO
     REPRODUCE THE CAPTURE CROSS SECTION OF 8.3 MILLI-BARNS AT 90
     KEV MEASURED BY TIMOKHOV ET AL./17/

   MT = 16  (N,2N) CROSS SECTION
   MT = 17  (N,3N) CROSS SECTION
   MT = 22  (N,N'A) CROSS SECTION
   MT = 28  (N,N'P) CROSS SECTION
   MT =103  (N,P) CROSS SECTION
   MT =104  (N,D) CROSS SECTION
   MT =105  (N,T) CROSS SECTION
   MT =107  (N,ALPHA) CROSS SECTION
     THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
     PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

     THE KALBACH'S CONSTANT K (= 215.9) WAS ESTIMATED BY THE
     FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/18/ AND LEVEL
     DENSITY PARAMETERS.

     FINALLY, THE (N,P) CROSS SECTION WAS NORMALIZED TO THE
     FOLLOWING VALUE AT 14.5 MEV:
       (N,P)          1.56  MB (SYSTEMATICS OF FORREST/19/)

   MT = 251  MU-BAR
     CALCULATED WITH CASTHY.

 MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
   LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
   GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
   TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
   CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
   BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

 MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
   ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
   PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
   OTHER NEUTRON EMITTING REACTIONS.

 TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
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         V  = 47.64-0.473E        R0 = 6.256    A0 = 0.62
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WS = 9.744 RS = 6.469 AS = 0.35
VSO= 7.0 RSO= 6.241 ASO= 0.62
THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
48-CD-120	*	1.718E+01	6.016E-01	1.880E-01	7.009E+00	2.790E+00
48-CD-121	*	1.693E+01	5.992E-01	1.734E+00	5.442E+00	1.360E+00
48-CD-122	*	1.667E+01	5.968E-01	2.388E-01	6.394E+00	2.450E+00
48-CD-123	*	1.641E+01	5.943E-01	1.268E+00	5.165E+00	1.360E+00
49-IN-121		1.601E+01	6.060E-01	1.119E+00	5.277E+00	1.430E+00
49-IN-122	*	1.707E+01	5.968E-01	1.737E+01	4.092E+00	0.0
49-IN-123		1.470E+01	6.100E-01	1.134E+00	4.483E+00	1.090E+00
49-IN-124		1.655E+01	5.240E-01	6.345E+00	2.747E+00	0.0
50-SN-122		1.434E+01	7.060E-01	3.423E-01	7.416E+00	2.620E+00
50-SN-123		1.509E+01	6.870E-01	3.062E+00	6.032E+00	1.190E+00
50-SN-124		1.601E+01	6.160E-01	3.224E-01	6.294E+00	2.280E+00
50-SN-125		1.591E+01	6.210E-01	1.927E+00	5.249E+00	1.190E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 7.975 FOR SN-124 AND 5.0 FOR SN-125.

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MAT number = 5067

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 50-SN-126 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  NO RESOLVED RESONANCE PARAMETERS

  UNRESOLVED RESONANCE REGION : 2 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/2/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.  THE RADIATON WIDTH GG WAS BASED ON THE SYSTEMATICS
    OF MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.750E-4, S1 = 2.500E-4, S2 = 0.670E-4, SG = 0.107E-4,
    GG = 0.150 EV, R  = 5.582 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S                RES. INTEG.
      TOTAL           4.090                     -
      ELASTIC         4.000                     -
      CAPTURE         0.09000                    0.150

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 2 KEV, THE CAPTURE AND ELASTIC SCATTERING CROSS SECTIONS
  WERE ASSUMED TO BE IN 1/V FORM AND CONSTANT, RESPECTIVELY.  THE
  CAPTURE CROSS SECTION AT 0.0253 EV WAS DETERMINED BY THE
  SYSTEMATICS FROM NEIGHBORING NUCLIDES, AND SCATTERING CROSS
  SECTION FROM R = 5.4 FM.  UNRESOLVED RESONANCE PARAMETERS WERE
  GIVEN IN THE ENERGY RANGE FROM 2 KEV TO 100 KEV.

  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/3/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED SO AS TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL
  CROSS SECTION BY CHANGING RSO OF IIJIMA-KAWAI POTENTIAL/4/. THE
  OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/5/
     ALPHA    = HUIZENGA AND IGO/6/
     DEUTERON = LOHR AND HAEBERLI/7/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/8/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/9/ WERE EVALUATED BY IIJIMA ET AL./10/   MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /11/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/12/ AND NUCLEAR DATA
    SHEETS/13/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             0  +
            1        1.1411          2  +
            2        2.0497          4  +
            3        2.1108          2  +
            4        2.1301          4  +
            5        2.1615          5  -
            6        2.1942          4  +
            7        2.2189          7  -
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LEVELS ABOVE 2.25 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/14/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (9.55E-06) WAS ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION OF 5 MILLI-BARNS AT 300 KEV, WHICH WAS ESTIMATED FROM THE DATA OF NEIGHBORING NUCLIDES.

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 232.5) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/15/ AND LEVEL DENSITY PARAMETERS.

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 47.64-0.473E	R0 = 6.256	A0 = 0.62
WS = 9.744	RS = 6.469	AS = 0.35
VSO= 7.0	RSO= 6.241	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
48-CD-122	*	1.667E+01	5.968E-01	2.388E-01	6.394E+00	2.450E+00
48-CD-123	*	1.641E+01	5.943E-01	1.268E+00	5.165E+00	1.360E+00
48-CD-124	*	1.614E+01	5.919E-01	1.426E-01	6.225E+00	2.560E+00
48-CD-125	*	1.587E+01	5.895E-01	9.238E-01	4.884E+00	1.360E+00
49-IN-123		1.470E+01	6.100E-01	1.134E+00	4.483E+00	1.090E+00
49-IN-124		1.655E+01	5.240E-01	6.345E+00	2.747E+00	0.0
49-IN-125	*	1.627E+01	5.895E-01	1.449E+00	4.874E+00	1.200E+00
49-IN-126		1.600E+01	5.160E-01	4.768E+00	2.470E+00	0.0
50-SN-124		1.601E+01	6.160E-01	3.224E-01	6.294E+00	2.280E+00
50-SN-125		1.591E+01	6.210E-01	1.927E+00	5.249E+00	1.190E+00
50-SN-126		1.646E+01	6.270E-01	4.012E-01	6.778E+00	2.390E+00
50-SN-127		1.577E+01	6.140E-01	1.633E+00	5.075E+00	1.190E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 1.141 FOR SN-126 AND 5.0 FOR SN-127.

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MAT number = 5100

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 51-SB-  0 JNDC       EVAL-MAR89 JNDC FP NUCLEAR DATA W.G.
                      DIST-OCT89 REV2-FEB94
HISTORY
89-03 DATA WERE CONSTRUCTED WITH THOSE FOR SB-121 AND SB-123 WHICH
      WERE EVALUATED BY JNDC FP NUCLEAR DATA W.G./1/.
90-07 UNRESOLVED RESONANCE PARAMETERS AND MF=3, MT=251 WERE
      MODIFIED.
90-10 SPECTRA AT THRESHOLD ENERGIES WERE MODIFIED.
94-02 JENDL-3.2
      CAPTURE CROSS SECTION MODIFIED BY JNDC FPND WG.
      OTHER DATA WERE ADOPTED FROM JENDL FUSION FILE.
      COMPILED BY T.NAKAGAWA

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      ALL CROSS SECTIONS EXCEPT (3,105).
          (3,32) AND (3,33) WERE DELETED.
      ALL ANGULAR DISTRIBUTIONS EXCEPT FOR (4,2).
      ALL ENERGY DISTRIBUTIONS.
     ***********************************************************
     -------------------------------------------------------------
      JENDL FUSION FILE /2/  (AS OF FEB. 1994)
            EVALUATED BY K.KOSAKO (NEDAC) AND S. CHIBA (NDC/JAERI)
            COMPILED  BY K.KOSAKO.

      -  THE INELASTIC SCATTERING CROSS SECTIONS AND ANGULAR
         DISTRIBUTIONS OF INELASTICALLY SCATTERED NEUTRONS (EXCEPT
         CONTINUUM INELASTIC) WERE CALCULATED WITH CASTHY2Y AND
         DWUCKY IN SINCROS-II SYSTEM/3/ INCLUDING CONTRIBUTIONS
         FROM DIRECT REACTIONS.
      -  THE (N,2N), (N,3N), (N,NA), (N,NP), (N,P), (N,D) AND
         (N,A) REACTION CROSS SECTIONS (MT=16, 17, 22, 28, 103,
         104, 107) WERE CALCULATED BY EGNASH2 IN THE SINCROS-II.
      -  THE (N,T) REACTION CROSS SECTION, RESONANCE PARAMETERS
         AND ANG. DISTRIBUTIONS OF ELASTICALLY SCATTERED NEUTRONS
         WERE TAKEN FROM JENDL-3.1.
      -  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE REPLACED
         BY THOSE CALCULATED BY EGNASH2.  THE DDX'S OF THE
         CONTINUUM NEUTRONS WERE CALCULATED BY KUMABE'S SYSTEMA-
         TICS /4/ USING F15TOB /2/.  THE PRECOMPOUND/COMPOUND
         RATIO WAS CALCULATED BY THE SINCROS- II CODE SYSTEM.
      -  OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED IN
         THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./3/.
         LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/5/.
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MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE PARAMETERS (MLBW FORMULA)
  1) SB-121 : BELOW 2 KEV
       EVALUATION WAS MADE ON THE BASIS OF DATA MEASURED BY
       OHKUBO ET AT./6,7/, BOLOTIN AND CHRIEN/8/, WYNCHANK ET
       AL./9/, MURADJAN ET AL./10/ AND ADAMCHUK ET AL./11/.
       ANGULAR MOMENTUM L AND SPIN J WERE BASED ON THE DATA BY
       BELYAEV ET AL./12/, BAHT ET AL./13/ AND CAUVIN ET AL./14/.
       THE AVERAGE RADIATIVE CAPTURE WIDTH OF 0.089 EV WAS
       ASSUMED.
  2) SB-123 : BELOW 2.5 KEV
       EVALUATION WAS MADE ON THE BASIS OF THE DATA MEASURED BY
       OHKUBO ET AL./6,15/, STOLVY AND HARVEY/16/, BOLOTIN AND
       CHRIEN/8/, WYNCHANK ET AL./9/, MURADJAN ET AL./10/ AND
       ADAMCHUK ET AL./11/.  ANGULAR MOMENTUM L AND SPIN J WERE
       BASED ON THE DATA BY BAHT ET AL./13/ AND CAUVIN ET AL./14/.
       THE AVERAGE RADIATIVE CAPTURE WIDTH OF 0.098 EV WAS
       ASSUMED.
  UNRESOLVED RESONANCE REGION : UP TO 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/17/.  THE OBSERVED LEVEL
    SPACING WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S                RES. INTEG.
      TOTAL           8.943                      -
      ELASTIC         3.722                      -
      CAPTURE         5.221                    175
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MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.

  FOR JENDL-3.1, ABOVE 100 KEV, THE SPHERICAL OPTICAL AND
  STATISTICAL MODEL CALCULATION WAS PERFORMED WITH CASTHY/17/, BY
  TAKING ACCOUNT OF COMPETING REACTIONS, OF WHICH CROSS SECTIONS
  WERE CALCULATED WITH PEGASUS/18/ STANDING ON A PREEQUILIBRIUM
  AND MULTI-STEP EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN
  IN TABLE 1 WERE ADOPTED FROM IIJIMA AND KAWAI/19/ BY MODIFYING
  RADIUS PARAMETER OF THE SPIN-ORBIT TERM.  THE OMP'S FOR CHARGED
  PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/20/
     ALPHA    = HUIZENGA AND IGO/21/
     DEUTERON = LOHR AND HAEBERLI/22/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/23/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GIRBERT
  AND CAMERON/24/ WERE EVALUATED BY IIJIMA ET AL./25/.  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /26/.

  FOR JENDL-3.2, ALL CROSS SECTION DATA EXCEPT FOR THE ELASTIC
  SCATTERING, CAPTURE AND (N,T) WERE ADOPTED FROM JENDL FUSION
  FILE.  THE CALCULATION WAS MADE WITH SINCROS-II SYSTEM/3/ BY
  ADOPTING WALTER-GUSS OMP MODIFIED BY YAMAMURO/3/ FOR NEUTRON,
  PEREY OMP /27/ FOR PROTON, LEMOS OMP MODIFIED BY ARTHUR AND
  YOUNG/28/ FOR ALPHA, LOHR-HAEBERLI OMP/29/ FOR DEUTERON,
  BECCHETTII-GREENLEES OMP/30/ FOR TRITON AND HE-3, AND STANDARD
  LEVEL DENSITY PARAMETERS OF SINCROS-II SYSTEM.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED IN THE ENERGY
    RANGES BELOW 500 KEV.  BETWEEN 500 KEV AND 11.5 MEV, SPLINE
    FITTING TO THE EXPERIMENTAL DATA /31,32/ WAS PERFORMED.  ABOVE
    THIS, EXPERIMENTAL DATA WERE CONNECTED BY EYE-GUIDING.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    THE CROSS SECTIONS WERE TAKEN FROM JENDL FUSION FILE.  THE
    LEVEL SCHEME WAS BASED ON REF./5/  CONTRIBUTIONS OF THE
    DIRECT PROCESS WERE CALCULATED FOR THE LEVELS MARKED WITH '*'.

          --- SB-121 ---                    --- SB-123 ---
    NO.  MT  ENERGY(MEV)  J-PARITY    NO.  MT  ENERGY(MEV)  J-PARITY
    GR.        0.0         5/2 +      GR.        0.0         7/2 +
     1   51    0.0371      7/2 + *     1   52    0.1603      5/2 + *
     2   53    0.5076      3/2 + *     2   54    0.5418      3/2 + *
     3   55    0.5731      1/2 + *     3   56    0.7128      1/2 +
     4   57    0.9470      9/2 + *     4   59    1.0302      9/2 + *
     5   58    1.0240      7/2 + *     5   61    1.0886      9/2 + *
     6   60    1.0354      9/2 +       6   64    1.1813      7/2 + *
     7   62    1.1393     11/2 +       7   65    1.2609      5/2 + *
     8   63    1.1447      9/2 + *     8   66    1.3374      7/2 + *
     9   67    1.3862      9/2 +
    10   68    1.4075      5/2 +
    11   69    1.4105      7/2 +
    12   70    1.4272      9/2 + *
    13   71    1.4480      1/2 -
       OVERLAPPING LEVELS WERE ASSUMED ABOVE 1.449 MEV FOR SB-121
       AND ABOVE 1.338 MEV FOR SB-123.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY/17/ WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/33/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTIONS WERE ADJUSTED TO REPRODUCE
    THE CAPTURE CROSS SECTIONS.
                CROSS SECTION (1 MEV)     STRENGTH FUNCTION
       SB-121         0.110 BARN               54.5E-4
       SB-123         0.084 BARN               24.2E-4

  MT = 16, 17, 22, 28, 103, 104, 107
          (N,2N), (N,3N), (N,N'A), (N,N'P), (N,P), (N,D)
          AND (N,ALPHA) CROSS SECTIONS
   ADOPTED FROM JENDL FUSION FILE.  THEORETICAL CALCULATION WAS
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MADE WITH SINCROS-II FOR EACH ISOTOPES, AND THE RESULTS WERE NORMALIZED TO EXPERIMENTAL DATA.

MT = 105 (N,T) CROSS SECTIONS
CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS/18/.

THE KALBACH'S CONSTANTS WERE ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/34/ AND LEVEL DENSITY PARAMETERS.
SB-121: 145.3, SB-123: 174.0

MT = 251 MU-BAR
CALCULATED WITH CASTHY/17/.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=2
CALCULATED WITH THE CASTHY CODE/17/.
MT=16, 17, 22, 28, 51-91
TAKEN FROM JENDL FUSION FILE.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=16, 17, 22, 28, 51-91
TAKEN FROM JENDL FUSION FILE.

<< THE PARAMETERS USED IN THE CASTHY AND PEGASUS CALCULATIONS.>>

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 47.64-0.473E	R0 = 6.256	A0 = 0.62
WS = 9.744	RS = 6.469	AS = 0.35
WSO= 7.0	RSO= 6.241	ASO= 0.62

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(/MEV)	T(MEV)	C(/MEV)	EX(MEV)	PAIRING
49-IN-117		1.678E+01	6.010E-01	2.387E+00	5.208E+00	1.150E+00
49-IN-118	*	1.804E+01	6.064E-01	3.111E+01	4.636E+00	0.0
49-IN-119		1.940E+01	5.340E-01	2.195E+00	4.999E+00	1.240E+00
49-IN-120	*	1.757E+01	6.016E-01	2.330E+01	4.366E+00	0.0
49-IN-121		1.601E+01	6.060E-01	1.119E+00	5.277E+00	1.430E+00
49-IN-122	*	1.707E+01	5.968E-01	1.737E+01	4.092E+00	0.0
50-SN-118		1.633E+01	6.140E-01	3.341E-01	6.448E+00	2.340E+00
50-SN-119		1.635E+01	5.990E-01	1.772E+00	5.050E+00	1.190E+00
50-SN-120		1.595E+01	6.540E-01	4.691E-01	7.083E+00	2.430E+00
50-SN-121		1.630E+01	6.100E-01	2.010E+00	5.217E+00	1.190E+00
50-SN-122		1.434E+01	7.060E-01	3.423E-01	7.416E+00	2.620E+00
50-SN-123		1.509E+01	6.870E-01	3.062E+00	6.032E+00	1.190E+00
51-SB-119	*	1.858E+01	6.040E-01	5.801E+00	5.944E+00	1.150E+00
51-SB-120	*	1.834E+01	6.016E-01	3.366E+01	4.659E+00	0.0
51-SB-121		1.730E+01	5.740E-01	1.715E+00	5.022E+00	1.240E+00
51-SB-122		1.772E+01	5.500E-01	1.346E+01	3.517E+00	0.0
51-SB-123		1.585E+01	6.213E-01	1.285E+00	5.469E+00	1.430E+00
51-SB-124		1.696E+01	5.600E-01	1.090E+01	3.433E+00	0.0

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

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MAT number = 5125

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 51-SB-121 JNDC       EVAL-AUG89 JNDC FP NUCLEAR DATA W.G.
                      DIST-SEP90 REV2-FEB94
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
89-08 MODIFICATION FOR JENDL-3 WAS MADE/2/.
94-02 JENDL-3.2
      CAPTURE CROSS SECTION MODIFIED BY JNDC FPND WG.
      OTHER DATA WERE ADOPTED FROM JENDL FUSION FILE.
      COMPILED BY T.NAKAGAWA

     *****   MODIFIED PARTS FOR JENDL-3.2   ******************
      ALL CROSS SECTIONS EXCEPT (3,105).
          (3,32) AND (3,33) WERE DELETED.
      ALL ANGULAR DISTRIBUTIONS EXCEPT FOR (4,2).
      ALL ENERGY DISTRIBUTIONS.
     **********************************************************
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      JENDL FUSION FILE /3/  (AS OF FEB. 1994)
            EVALUATED BY K.KOSAKO (NEDAC) AND S. CHIBA (NDC/JAERI)
            COMPILED  BY K.KOSAKO.

      -  THE INELASTIC SCATTERING CROSS SECTIONS AND ANGULAR
         DISTRIBUTIONS OF INELASTICALLY SCATTERED NEUTRONS (EXCEPT
         CONTINUUM INELASTIC) WERE CALCULATED WITH CASTHY2Y AND
         DWUCKY IN SINCROS-II SYSTEM/4/ INCLUDING CONTRIBUTIONS
         FROM DIRECT REACTIONS.
      -  THE (N,2N), (N,3N), (N,NA), (N,NP), (N,P), (N,D) AND
         (N,A) REACTION CROSS SECTIONS (MT=16, 17, 22, 28, 103,
         104, 107) WERE CALCULATED BY EGNASH2 IN THE SINCROS-II.
      -  THE (N,T) REACTION CROSS SECTION, RESONANCE PARAMETERS
         AND ANG. DISTRIBUTIONS OF ELASTICALLY SCATTERED NEUTRONS
         WERE TAKEN FROM JENDL-3.1.
      -  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE REPLACED
         BY THOSE CALCULATED BY EGNASH2.  THE DDX'S OF THE
         CONTINUUM NEUTRONS WERE CALCULATED BY KUMABE'S SYSTEMA-
         TICS /5/ USING F15TOB /3/.  THE PRECOMPOUND/COMPOUND
         RATIO WAS CALCULATED BY THE SINCROS- II CODE SYSTEM.
      -  OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED IN
         THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./4/.
         LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/6/.
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MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 2 KEV
    RESONANCE PARAMETERS OF JENDL-2/1/ WERE REVISED EXCEPT FOR
    RADIATION WIDTHS.
       EVALUATION OF JENDL-2 WAS MADE ON THE BASIS OF THE DATA
    MEASURED BY BOLOTIN AND CHRIEN/7/, WYNCHANK ET AL./8/,
    MURADJAN ET AL./9/, ADAMCHUK ET AL./10/ AND OHKUBO ET AL.
    /11/  NEUTRON ORBITAL ANGULAR MOMENTUM L AND TOTAL SPIN J
    WERE BASED ON THE DATA BY BHAT ET AL./12/ AND CAUVIN ET AL.
    /13/ THE AVERAGE RADIATION WIDTH OF 0.089 EV WAS DEDUCED AND
    APPLIED TO THE LEVELS WHOSE RADIATION WIDTH WAS UNKNOWN.
    AFTER THAT, NEW EXPERIMENTAL DATA FOR NEUTRON WIDTHS AND
    TOTAL SPIN J WERE PUBLISHED BY OHKUBO ET AL./14/ AND BELIAEV
    ET AL./15/, RESPECTIVELY.
       EVALUATION OF JENDL-3 WAS PERFORMED ON THE BASIS OF THE
    NEW DATA FOR THE NEUTRON WIDTHS AND SPIN J AND JENDL-2 FOR
    THE RADIATION WIDTHS.  TOTAL SPIN J OF SOME RESONANCES WAS
    TENTATIVELY ESTIMATED WITH A RANDOM NUMBER METHOD.  NEUTRON
    ORBITAL ANGULAR MOMENTUM L WAS ESTIMATED WITH A METHOD OF
    BOLLINGER AND THOMAS/16/.  SCATTERING RADIUS OF 6.0 FM WAS
    ASSUMED FROM THE SYSTEMATICS OF MEASURED VALUES FOR
    NEIGHBORING NUCLIDES.

  UNRESOLVED RESONANCE REGION : 2 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTION S0 WAS BASED ON THE COMPILATION
    OF MUGHABGHAB ET AL./17/, AND S1 AND S2 WERE CALCULATED WITH
    OPTICAL MODEL CODE CASTHY/18/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH WAS BASED ON THE COMPILATION OF MUGHABGHAB
    ET AL.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
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    S0 = 0.300E-4, S1 = 2.700E-4, S2 = 0.760E-4, SG = 59.8E-4,
    GG = 0.100 EV, R  = 5.838 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                      2200 M/S               RES. INTEG.
      TOTAL           9.582                     -
      ELASTIC         3.590                     -
      CAPTURE         5.991                   214

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.

  FOR JENDL-3.1, ABOVE 100 KEV, THE SPHERICAL OPTICAL AND
  STATISTICAL MODEL CALCULATION WAS PERFORMED WITH CASTHY, BY
  TAKING ACCOUNT OF COMPETING REACTIONS, OF WHICH CROSS SECTIONS
  WERE CALCULATED WITH PEGASUS/19/ STANDING ON A PREEQUILIBRIUM
  AND MULTI-STEP EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN
  IN TABLE 1 WERE DETERMINED SO AS TO REPRODUCE A SYSTEMATIC TREND
  OF THE TOTAL CROSS SECTION BY CHANGING RSO OF IIJIMA-KAWAI
  POTENTIAL/20/. THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/21/
     ALPHA    = HUIZENGA AND IGO/22/
     DEUTERON = LOHR AND HAEBERLI/23/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/24/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/25/ WERE EVALUATED BY IIJIMA ET AL./26/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /27/.

  FOR JENDL-3.2, ALL CROSS SECTION DATA EXCEPT FOR THE ELASTIC
  SCATTERING, CAPTURE AND (N,T) WERE ADOPTED FROM JENDL FUSION
  FILE.  THE CALCULATION WAS MADE WITH SINCROS-II SYSTEM/4/ BY
  ADOPTING WALTER-GUSS OMP MODIFIED BY YAMAMURO/4/ FOR NEUTRON,
  PEREY OMP /28/ FOR PROTON, LEMOS OMP MODIFIED BY ARTHUR AND
  YOUNG/29/ FOR ALPHA, LOHR-HAEBERLI OMP/30/ FOR DEUTERON,
  BECCHETTII-GREENLEES OMP/31/ FOR TRITON AND HE-3, AND STANDARD
  LEVEL DENSITY PARAMETERS OF SINCROS-II SYSTEM.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WITH THE MODIFIED WALTER-
    GUSS OMP/4/ WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    THE CROSS SECTIONS WERE TAKEN FROM JENDL FUSION FILE.  THE
    LEVEL SCHEME WAS BASED ON REF./6/  CONTRIBUTIONS OF THE
    DIRECT PROCESS WERE CALCULATED FOR THE LEVELS MARKED WITH '*'.

           NO.      ENERGY(MEV)    SPIN-PARITY (DIRECT PROCESS)
           GR.       0.0            5/2 +
            1        0.0371         7/2 +          *
            2        0.5076         3/2 +          *
            3        0.5731         1/2 +          *
            4        0.9470         9/2 +          *
            5        1.0240         7/2 +          *
            6        1.0354         9/2 +
            7        1.1393        11/2 +
            8        1.1447         7/2 +          *
            9        1.3862         9/2 +
           10        1.4075         5/2 +
           11        1.4105         7/2 +
           12        1.4272         9/2 +          *
           13        1.4480         1/2 -
         LEVELS ABOVE 1.449 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/32/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (54.5E-4) WAS ADJUSTED TO
    REPRODUCE THE CAPTURE CROSS SECTION OF 110 MILLI-BARNS AT 1
    MEV WHICH WAS AN AVERAGE VALUE OF EXPERIMENTAL DATA OF
    TROFIMOV/33/ AND OUR PREVIOUS EVALUATION NORMALIZED TO 150 MB
    AT 500 KEV/34/.
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  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
   ADOPTED FROM JENDL FUSION FILE.  THEORETICAL CALCULATION WAS
   MADE WITH SINCROS-II.  THE RESULTS WERE NORMALIZED TO

  (N,D)+(N,NP) 0.00415 B AT 14.5 MEV (SYSTEMATICS OF FORREST/35/),
        (N,A)   0.0036 B AT 14.9 MEV (SYSTEMATICS OF KONNO+/36/).

   AND THE (N,2N) CROSS SECTION WAS ADJUSTED TO THE ENERGY
   DISTRIBUTIONS OF EMITTED NEUTRONS (A FACTOR OF 1.27 WAS
   APPLIED).

  MT =105  (N,T) CROSS SECTION
    THIS REACTION CROSS SECTION WAS CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (= 145.3) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/37/ AND LEVEL
    DENSITY PARAMETERS.

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=2
   CALCULATED WITH THE CASTHY CODE/20/.
 MT=16, 17, 22, 28, 51-91
   TAKEN FROM JENDL FUSION FILE.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=16, 17, 22, 28, 91
   TAKEN FROM JENDL FUSION FILE.


<< THE PARAMETERS USED IN THE CASTHY AND PEGASUS CALCULATIONS. >>

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
         ----------------------   ------------  ---------------
        V  = 47.64-0.473E         R0 = 6.256    A0 = 0.62
        WS = 9.744                RS = 6.469    AS = 0.35
        VSO= 7.0                  RSO= 6.241    ASO= 0.62
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2  LEVEL DENSITY PARAMETERS

 NUCLIDE  SYST A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
 ---------------------------------------------------------------
 49-IN-117      1.678E+01 6.010E-01 2.387E+00 5.208E+00 1.150E+00
 49-IN-118  *   1.804E+01 6.064E-01 3.111E+01 4.636E+00 0.0
 49-IN-119      1.940E+01 5.340E-01 2.195E+00 4.999E+00 1.240E+00
 49-IN-120  *   1.757E+01 6.016E-01 2.330E+01 4.366E+00 0.0

 50-SN-118      1.633E+01 6.140E-01 3.341E-01 6.448E+00 2.340E+00
 50-SN-119      1.635E+01 5.990E-01 1.772E+00 5.050E+00 1.190E+00
 50-SN-120      1.595E+01 6.540E-01 4.691E-01 7.083E+00 2.430E+00
 50-SN-121      1.630E+01 6.100E-01 2.010E+00 5.217E+00 1.190E+00

 51-SB-119  *   1.858E+01 6.040E-01 5.801E+00 5.944E+00 1.150E+00
 51-SB-120  *   1.834E+01 6.016E-01 3.366E+01 4.659E+00 0.0
 51-SB-121      1.730E+01 5.740E-01 1.715E+00 5.022E+00 1.240E+00
 51-SB-122      1.772E+01 5.500E-01 1.346E+01 3.517E+00 0.0
 ---------------------------------------------------------------
  SYST:  * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

 SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
 IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
 ASSUMED TO BE 9.25 FOR SB-121 AND 5.0 FOR SB-122.
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MAT number = 5131

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 51-SB-123 JNDC       EVAL-AUG89 JNDC FP NUCLEAR DATA W.G.
                      DIST-SEP90 REV2-FEB94
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
89-08 MODIFICATION FOR JENDL-3 WAS MADE/2/.
94-02 JENDL-3.2
      CAPTURE CROSS SECTION MODIFIED BY JNDC FPND WG.
      OTHER DATA WERE ADOPTED FROM JENDL FUSION FILE.
      COMPILED BY T.NAKAGAWA

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      ALL CROSS SECTIONS EXCEPT (3,105).
          (3,32) AND (3,33) WERE DELERTED.
      ALL ANGULAR DISTRIBUTIONS EXCEPT FOR (4,2).
      ALL ENERGY DISTRIBUTIONS.
     ***********************************************************
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      JENDL FUSION FILE /3/  (AS OF FEB. 1994)
            EVALUATED BY K.KOSAKO (NEDAC) AND S. CHIBA (NDC/JAERI)
            COMPILED  BY K.KOSAKO.

       -  THE INELASTIC SCATTERING CROSS SECTIONS AND ANGULAR
          DISTRIBUTIONS OF INELASTICALLY SCATTERED NEUTRONS (EXCEPT
          CONTINUUM INELASTIC) WERE CALCULATED WITH CASTHY2Y AND
          DWUCKY IN SINCROS-II SYSTEM/4/ INCLUDING CONTRIBUTIONS
          FROM DIRECT REACTIONS.
       -  THE (N,2N), (N,3N), (N,NA), (N,NP), (N,P), (N,D) AND
          (N,A) REACTION CROSS SECTIONS (MT=16, 17, 22, 28, 103,
          104, 107) WERE CALCULATED BY EGNASH2 IN THE SINCROS-II.
       -  THE (N,T) REACTION CROSS SECTION, RESONANCE PARAMETERS
          AND ANG. DISTRIBUTIONS OF ELASTICALLY SCATTERED NEUTRONS
          WERE TAKEN FROM JENDL-3.1.
       -  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE REPLACED
          BY THOSE CALCULATED BY EGNASH2.  THE DDX'S OF THE
          CONTINUUM NEUTRONS WERE CALCULATED BY KUMABE'S SYSTEMA-
          TICS /5/ USING F15TOB /3/.  THE PRECOMPOUND/COMPOUND
          RATIO WAS CALCULATED BY THE SINCROS- II CODE SYSTEM.
       -  OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED IN
          THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./4/.
          LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/6/.
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MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 2.5 KEV
    RESONANCE PARAMETERS OF JENDL-2/1/ WERE REVISED EXCEPT FOR
    RADIATION WIDTHS.
       EVALUATION FOR JENDL-2 WAS MADE ON THE BASIS OF THE DATA
    MEASURED BY STOLVY AND HARVEY/7/, BOLOTIN AND CHRIEN/8/,
    WYNCHANK ET AL./9/, MURADJAN ET AL./10/, ADAMCHUK ET AL./11/,
    OHKUBO ET AL./12/ AND OHKUBO/13/.  ANGULAR MOMENTUM L AND SPIN
    J WERE BASED ON THE DATA BY BHAT ET AL./14/ AND CAUVIN ET AL.
    /15/.  THE AVERAGE RADIATION WIDTH OF 0.098 EV WAS DEDUCED AND
    APPLIED TO THE LEVELS WHOSE RADIATION WIDTH WAS UNKNOWN.
    NEGATIVE RESONANCE WAS ADDED SO AS TO REPRODUCE THE THERMAL
    CAPTURE CROSS SECTION GIVEN BY MUGHABGHAB ET AL./16/
       AFTER THE EVALUATION FOR JENDL-2, NEW EXPERIMENTAL DATA OF
    NEUTRON WIDTHS WERE PUBLISHED BY OHKUBO ET AL./17/ EVALUATION
    OF JENDL-3 WAS MADE ON THE BASIS OF THE NEW EXPERIMENTAL DATA
    FOR THE NEUTRON WIDTHS AND PREVIOUS ONES FOR THE RADIATION
    WITHDS AND TOTAL SPIN J.  TOTAL SPIN J OF SOME RESONANCES WAS
    TENTATIVELY ESTIMATED WITH A RANDOM NUMBER METHOD.  NEUTRON
    ORBITAL ANGULAR MOMENTUM L WAS ESTIMATED WITH A METHOD OF
    BOLLINGER AND THOMAS/18/.  SCATTERING RADIUS OF 6.0 FM WAS
    ASSUMED FROM THE SYSTEMATICS OF MEASURED VALUES FOR NEIGHBOR-
    ING NUCLIDES.  PARAMETERS OF A NEGATIVE RESONANCE WERE ALSO
    MODIFIED SO AS TO REPRODUCE THE THERMAL CAPTURE CROSS
    SECTION/16/.

  UNRESOLVED RESONANCE REGION : 2.5 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTION S0 WAS BASED ON THE COMPILATION
    OF MUGHABGHAB ET AL./16/, AND S1 AND S2 WERE CALCULATED WITH
    OPTICAL MODEL CODE CASTHY/19/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH WAS BASED ON THE COMPILATION OF MUGHABGHAB
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    ET AL.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.250E-4, S1 = 2.700E-4, S2 = 0.760E-4, SG = 26.6E-4,
    GG = 0.100 EV, R  = 5.857 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                    2200 M/S               RES. INTEG.
      TOTAL          8.086                     -
      ELASTIC        3.899                     -
      CAPTURE        4.187                    123

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.

  FOR JENDL-3.1, ABOVE 100 KEV, THE SPHERICAL OPTICAL AND
  STATISTICAL MODEL CALCULATION WAS PERFORMED WITH CASTHY, BY
  TAKING ACCOUNT OF COMPETING REACTIONS, OF WHICH CROSS SECTIONS
  WERE CALCULATED WITH PEGASUS/20/ STANDING ON A PREEQUILIBRIUM
  AND MULTI-STEP EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN
  IN TABLE 1 WERE DETERMINED SO AS TO REPRODUCE A SYSTEMATIC TREND
  OF THE TOTAL CROSS SECTION BY CHANGING RSO OF IIJIMA-KAWAI
  POTENTIAL/21/.  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/22/
     ALPHA    = HUIZENGA AND IGO/23/
     DEUTERON = LOHR AND HAEBERLI/24/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/25/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/26/ WERE EVALUATED BY IIJIMA ET AL./27/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /28/.

  FOR JENDL-3.2, ALL CROSS SECTION DATA EXCEPT FOR THE ELASTIC
  SCATTERING, CAPTURE AND (N,T) WERE ADOPTED FROM JENDL FUSION
  FILE.  THE CALCULATION WAS MADE WITH SINCROS-II SYSTEM/4/ BY
  ADOPTING WALTER-GUSS OMP MODIFIED BY YAMAMURO/4/ FOR NEUTRON,
  PEREY OMP /29/ FOR PROTON, LEMOS OMP MODIFIED BY ARTHUR AND
  YOUNG/30/ FOR ALPHA, LOHR-HAEBERLI OMP/31/ FOR DEUTERON,
  BECCHETTII-GREENLEES OMP/32/ FOR TRITON AND HE-3, AND STANDARD
  LEVEL DENSITY PARAMETERS OF SINCROS-II SYSTEM.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WITH THE MODIFIED WALTER-
    GUSS OMP?4/ WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    THE CROSS SECTIONS WERE TAKEN FROM JENDL FUSION FILE.  THE
    LEVEL SCHEME WAS BASED ON REF./6/  CONTRIBUTIONS OF THE
    DIRECT PROCESS WERE CALCULATED FOR THE LEVELS MARKED WITH '*'.

           NO.      ENERGY(MEV)    SPIN-PARITY (DIRECT PROCESS)
           GR.       0.0             7/2 +
            1        0.1603          5/2 +          *
            2        0.5418          3/2 +          *
            3        0.7128          1/2 +
            4        1.0302          9/2 +          *
            5        1.0886          9/2 +          *
            6        1.1813          7/2 +          *
            7        1.2609          5/2 +          *
            8        1.3374          7/2 +          *
      LEVELS ABOVE 1.338 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/33/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (24.2E-4) WAS ADJUSTED TO
    REPRODUCE THE CAPTURE CROSS SECTION OF 84 MB AT 1.0 MEV WHICH
    WAS AN AVERAGE VALUE OF EXPERIMENTAL DATA OF TROFIMOV/34/
    AND OUR PREVIOUS EVALUATION NORMALIZED TO 100 MB AT 500
    KEV/35/.

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
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MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
ADOPTED FROM JENDL FUSION FILE. THEORETICAL CALCULATION WAS MADE WITH SINCROS-II. THE RESULTS WERE NORMALIZED TO

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(N,D)+(N,NP) 0.00201 B AT 14.5 MEV (SYSTEMATICS OF FORREST/36/),
      (N,P)  0.0078  B AT 14.9 MEV (SYSTEMATICS OF KONNO+/37/).
      (N,A)  0.00225 B AT 14.9 MEV (SYSTEMATICS OF KONNO+/37/).
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AND THE (N,2N) CROSS SECTION WAS ADJUSTED TO THE ENERGY DISTRIBUTIONS OF EMITTED NEUTRONS (A FACTOR OF 1.16 WAS APPLIED).

MT =105 (N,T) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 174.0) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/38/ AND LEVEL DENSITY PARAMETERS.

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=2
CALCULATED WITH THE CASTHY CODE/21/.
MT=16, 17, 22, 28, 51-91
TAKEN FROM JENDL FUSION FILE.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=16, 17, 22, 28, 91
TAKEN FROM JENDL FUSION FILE.

<< THE PARAMETERS USED IN THE CASTHY AND PEGASUS CALCULATIONS. >>

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 47.64-0.473E	R0 = 6.256	A0 = 0.62
WS = 9.744	RS = 6.469	AS = 0.35
VSO= 7.0	RSO= 6.241	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
49-IN-119		1.940E+01	5.340E-01	2.195E+00	4.999E+00	1.240E+00
49-IN-120	*	1.757E+01	6.016E-01	2.330E+01	4.366E+00	0.0
49-IN-121		1.601E+01	6.060E-01	1.119E+00	5.277E+00	1.430E+00
49-IN-122	*	1.707E+01	5.968E-01	1.737E+01	4.092E+00	0.0
50-SN-120		1.595E+01	6.540E-01	4.691E-01	7.083E+00	2.430E+00
50-SN-121		1.630E+01	6.100E-01	2.010E+00	5.217E+00	1.190E+00
50-SN-122		1.434E+01	7.060E-01	3.423E-01	7.416E+00	2.620E+00
50-SN-123		1.509E+01	6.870E-01	3.062E+00	6.032E+00	1.190E+00
51-SB-121		1.730E+01	5.740E-01	1.715E+00	5.022E+00	1.240E+00
51-SB-122		1.772E+01	5.500E-01	1.346E+01	3.517E+00	0.0
51-SB-123		1.585E+01	6.213E-01	1.285E+00	5.469E+00	1.430E+00
51-SB-124		1.696E+01	5.600E-01	1.090E+01	3.433E+00	0.0

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 6.399 FOR SB-123 AND 5.0 FOR SB-124.

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MAT number = 5134

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 51-SB-124 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  NO RESOLVED RESONANCE PARAMETERS

  UNRESOLVED RESONANCE REGION : 2.54 EV - 100 KEV
    THE NEUTRON STRENGTH FUNCTION, S0, WAS ESTIMATED FROM THOSE OF
    OTHER SB ISOTOPES, AND S1 AND S2 WERE CALCULATED WITH OPTICAL
    MODEL CODE CASTHY/3/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY AT 100 KEV.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.300E-4, S1 = 2.700E-4, S2 = 0.760E-4, SG = 211.E-4,
    GG = 0.100 EV, R  = 5.700 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S              RES. INTEG.
      TOTAL          21.16                    -
      ELASTIC         3.760                   -
      CAPTURE        17.40                  156

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 2.54 EV, THE CAPTURE AND ELASTIC SCATTERING CROSS SECTIONS
  WERE ASSUMED TO BE IN 1/V FORM AND CONSTANT, RESPECTIVELY.  THE
  CAPTURE CROSS SECTION AT 0.0253 EV WAS TAKEN FROM THE
  COMPILATION BY MUGHABGHAB ET AL./4/ UNRESOLVED RESONANCE
  PARAMETERS WERE GIVEN IN THE ENERGY RANGE FROM 2.54 EV TO 100
  KEV.

  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/5/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING RSO OF IIJIMA-KAWAI POTENTIAL/6/.  THE
  OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/7/
     ALPHA    = HUIZENGA AND IGO/8/
     DEUTERON = LOHR AND HAEBERLI/9/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/10/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/11/ WERE EVALUATED BY IIJIMA ET AL./12/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /13/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./14/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             3  -
            1        0.0107          5  +
      LEVELS ABOVE 0.041 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/15/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.
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THE GAMMA-RAY STRENGTH FUNCTION (1.97E-02) WAS DETERMINED FROM THE SYSTEMATICS OF RADIATION WIDTH (0.1 EV) AND THE AVERAGE S-WAVE RESONANCE LEVEL SPACING (5.08 EV) CALCULATED FROM THE LEVEL DENSITY PARAMETERS.

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT = 32 (N,N'D) CROSS SECTION
MT = 33 (N,N'T) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 176.9) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/16/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,P)	3.53 MB	(SYSTEMATICS OF FORREST/17/)
(N,ALPHA)	1.91 MB	(SYSTEMATICS OF FORREST)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING FROM OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 47.64-0.473E	R0 = 6.256	A0 = 0.62
WS = 9.744	RS = 6.469	AS = 0.35
VSO= 7.0	RSO= 6.241	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
49-IN-120	*	1.757E+01	6.016E-01	2.330E+01	4.366E+00	0.0
49-IN-121		1.601E+01	6.060E-01	1.119E+00	5.277E+00	1.430E+00
49-IN-122	*	1.707E+01	5.968E-01	1.737E+01	4.092E+00	0.0
49-IN-123		1.470E+01	6.100E-01	1.134E+00	4.483E+00	1.090E+00
50-SN-121		1.630E+01	6.100E-01	2.010E+00	5.217E+00	1.190E+00
50-SN-122		1.434E+01	7.060E-01	3.423E-01	7.416E+00	2.620E+00
50-SN-123		1.509E+01	6.870E-01	3.062E+00	6.032E+00	1.190E+00
50-SN-124		1.601E+01	6.160E-01	3.224E-01	6.294E+00	2.280E+00
51-SB-122		1.772E+01	5.500E-01	1.346E+01	3.517E+00	0.0
51-SB-123		1.585E+01	6.213E-01	1.285E+00	5.469E+00	1.430E+00
51-SB-124		1.696E+01	5.600E-01	1.090E+01	3.433E+00	0.0
51-SB-125		1.700E+01	5.120E-01	7.883E-01	3.792E+00	1.090E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 5.0 FOR SB-124 AND 7.267 FOR SB-125.

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MAT number = 5137
 51-SB-125 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  NO RESOLVED RESONANCE PARAMETERS

  UNRESOLVED RESONANCE REGION : 14 EV - 100 KEV
    THE NEUTRON STRENGTH FUNCTION S0 WAS DETERMINED WITH THE LOCAL
    SYSTEMATICS/2/, AND S1 AND S2 WERE CALCULATED WITH OPTICAL
    MODEL CODE CASTHY/3/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    AT 100 KEV WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.  THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS
    OF MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.300E-4, S1 = 2.500E-4, S2 = 0.680E-4, SG = 61.2E-4,
    GG = 0.150 EV, R  = 5.908 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           9.000                   -
      ELASTIC         4.000                   -
      CAPTURE         5.000                  55.7

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 14 EV, THE CAPTURE AND ELASTIC SCATTERING CROSS SECTIONS
  WERE ASSUMED TO BE IN 1/V FORM AND CONSTANT, RESPECTIVELY.  THE
  CAPTURE CROSS SECTION AT 0.0253 EV WAS DETERMINED BY THE
  SYSTEMTICS FROM NEIGHBORING NUCLIDES.  THE ELASTIC SCATTERING
  CROSS SECTION WAS ESTIMATED FROM R = 5.4 FM.  UNRESOLVED
  RESONANCE PARAMETERS WERE GIVEN IN THE ENERGY RANGE FROM 14 EV
  TO 100 KEV.

  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/4/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED SO AS TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL
  CROSS SECTION BY CHANGING RSO OF IIJIMA-KAWAI POTENTIAL/5/.  THE
  OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/6/
     ALPHA    = HUIZENGA AND IGO/7/
     DEUTERON = LOHR AND HAEBERLI/8/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/9/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/10/ WERE EVALUATED BY IIJIMA ET AL./11/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /12/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/13/ AND NUCLEAR DATA
    SHEETS/14/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             7/2 +
            1        0.3321          5/2 +
            2        0.6429          3/2 +
            3        0.9216          1/2 +
            4        1.0671          9/2 +
            5        1.0892         11/2 +
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              6         1.3495          7/2 +
              7         1.4197          9/2 +
              8         1.4839          3/2 +
              9         1.5914          7/2 +
             10         1.7356          3/2 +
             11         1.8000          1/2 +
             12         1.8063          9/2 +
             13         1.8895         11/2 -
             14         1.9472          3/2 +
             15         1.9826         11/2 -
             16         2.0018          9/2 +
             17         2.1130          1/2 -
             18         2.2007          9/2 +
             19         2.2405          9/2 +
             20         2.2531          9/2 +
             21         2.2754          9/2 +
             22         2.2880          9/2 +
             23         2.2990          1/2 -
             24         2.5150          1/2 -
             25         2.5700          1/2 +
             26         2.6700          1/2 +
             27         2.6780          5/2 +
             28         2.7100          1/2 +
        LEVELS ABOVE 2.78 MEV WERE ASSUMED TO BE OVERLAPPING.

    MT = 102  CAPTURE
      SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
      CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
      SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
      AND REFFO/15/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

      THE GAMMA-RAY STRENGTH FUNCTION (5.25E-03) WAS DETERMINED FROM
      THE SYSTEMATICS OF RADIATION WIDTH (0.15 EV) AND THE AVERAGE
      S-WAVE RESONANCE LEVEL SPACING (28.6 EV) CALCULATED FROM THE
      LEVEL DENSITY PARAMETERS.

    MT = 16  (N,2N) CROSS SECTION
    MT = 17  (N,3N) CROSS SECTION
    MT = 22  (N,N'A) CROSS SECTION
    MT = 28  (N,N'P) CROSS SECTION
    MT = 32  (N,N'D) CROSS SECTION
    MT = 33  (N,N'T) CROSS SECTION
    MT =103  (N,P) CROSS SECTION
    MT =104  (N,D) CROSS SECTION
    MT =105  (N,T) CROSS SECTION
    MT =107  (N,ALPHA) CROSS SECTION
      THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
      PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

      THE KALBACH'S CONSTANT K (= 181.2) WAS ESTIMATED BY THE
      FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/16/ AND LEVEL
      DENSITY PARAMETERS.

      FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
      NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
        (N,P)           2.58  MB (SYSTEMATICS OF FORREST/17/)
        (N,ALPHA)       1.45  MB (SYSTEMATICS OF FORREST)

    MT = 251  MU-BAR
      CALCULATED WITH CASTHY.

  MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
    LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
    GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
    TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
    CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
    BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

  MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
    ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
    PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
    OTHER NEUTRON EMITTING REACTIONS.

  TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                 DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
           ----------------------  ------------  ---------------
          V  = 47.64-0.473E        R0 = 6.256    A0 = 0.62
          WS = 9.744               RS = 6.469    AS = 0.35
          VSO= 7.0                 RSO= 6.241    ASO= 0.62
    THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.
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TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
49-IN-121		1.601E+01	6.060E-01	1.119E+00	5.277E+00	1.430E+00
49-IN-122	*	1.707E+01	5.968E-01	1.737E+01	4.092E+00	0.0
49-IN-123		1.470E+01	6.100E-01	1.134E+00	4.483E+00	1.090E+00
49-IN-124		1.655E+01	5.240E-01	6.345E+00	2.747E+00	0.0
50-SN-122		1.434E+01	7.060E-01	3.423E-01	7.416E+00	2.620E+00
50-SN-123		1.509E+01	6.870E-01	3.062E+00	6.032E+00	1.190E+00
50-SN-124		1.601E+01	6.160E-01	3.224E-01	6.294E+00	2.280E+00
50-SN-125		1.591E+01	6.210E-01	1.927E+00	5.249E+00	1.190E+00
51-SB-123		1.585E+01	6.213E-01	1.285E+00	5.469E+00	1.430E+00
51-SB-124		1.696E+01	5.600E-01	1.090E+01	3.433E+00	0.0
51-SB-125		1.700E+01	5.120E-01	7.883E-01	3.792E+00	1.090E+00
51-SB-126		1.700E+01	5.250E-01	7.566E+00	2.897E+00	0.0

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 7.267 FOR SB-125 AND 5.0 FOR SB-126.

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MAT number = 5225

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 52-TE-120 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  NO RESOLVED RESONANCE PARAMETERS

  UNRESOLVED RESONANCE REGION : 68 EV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/2/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.  THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS
    OF MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.970E-4, S1 = 1.700E-4, S2 = 1.100E-4, SG = 7.72E-4,
    GG = 0.100 EV, R  = 5.376 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           5.980                   -
      ELASTIC         3.640                   -
      CAPTURE         2.340                  22.5

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 68 EV, THE CAPTURE AND ELASTIC SCATTERING CROSS SECTIONS
  WERE ASSUMED TO BE IN 1/V FORM AND CONSTANT, RESPECTIVELY.  THE
  CAPTURE CROSS SECTION AT 0.0253 WAS ADOPTED FROM REF./3/ AND
  THE ELASTIC SCATTERING CROSS SECTION WAS ESTIMATED FROM R = 5.4
  FM.  UNRESOLVED RESONANCE PARAMETERS WERE GIVEN IN THE ENERGY
  RANGE FROM 68 EV TO 100 KEV.

  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/4/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED SO AS TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL
  CROSS SECTION BY CHANGING R0 AND RS0 OF IIJIMA-KAWAI POTENTIAL
  /5/.  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/6/
     ALPHA    = HUIZENGA AND IGO/7/
     DEUTERON = LOHR AND HAEBERLI/8/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/9/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/10/ WERE EVALUATED BY IIJIMA ET AL./11/   MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /12/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/13/ AND NUCLEAR DATA
    SHEETS/14/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             0  +
            1        0.5604          2  +
            2        1.1031          0  +
            3        1.1615          4  +
            4        1.2017          2  +
            5        1.7762          6  +
            6        1.8635          3  +
            7        2.0834          3  -
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8 2.1085 1 +

LEVELS ABOVE 2.202 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/15/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (7.41E-04) WAS DETERMINED FROM THE SYSTEMATICS OF RADIATION WIDTH (0.1 EV) AND THE AVERAGE S-WAVE RESONANCE LEVEL SPACING (135 EV) CALCULATED FROM THE LEVEL DENSITY PARAMETERS.

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT = 32 (N,N'D) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =106 (N,HE3) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 135.2) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/16/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
(N,P) 26.60 MB (SYSTEMATICS OF FORREST/17/)
(N,ALPHA) 12.30 MB (SYSTEMATICS OF FORREST)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 45.97-0.199E	R0 = 6.481	A0 = 0.62
WS = 6.502	RS = 6.926	AS = 0.35
VSO= 7.0	RSO= 6.49	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
50-SN-116		1.529E+01	6.680E-01	3.763E-01	7.111E+00	2.510E+00
50-SN-117		1.583E+01	5.960E-01	1.352E+00	4.804E+00	1.190E+00
50-SN-118		1.633E+01	6.140E-01	3.341E-01	6.448E+00	2.340E+00
50-SN-119		1.635E+01	5.990E-01	1.772E+00	5.050E+00	1.190E+00
51-SB-117	*	1.902E+01	6.089E-01	5.934E+00	6.380E+00	1.320E+00
51-SB-118	*	1.880E+01	6.064E-01	4.497E+01	4.927E+00	0.0
51-SB-119	*	1.858E+01	6.040E-01	5.801E+00	5.944E+00	1.150E+00
51-SB-120	*	1.834E+01	6.016E-01	3.366E+01	4.659E+00	0.0
52-TE-118	*	1.918E+01	6.064E-01	9.376E-01	7.533E+00	2.460E+00
52-TE-119		1.819E+01	6.210E-01	6.418E+00	6.117E+00	1.140E+00
52-TE-120		1.700E+01	5.940E-01	3.471E-01	6.309E+00	2.290E+00
52-TE-121		1.800E+01	6.200E-01	5.720E+00	6.022E+00	1.140E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).

IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 6.375 FOR TE-120 AND 5.0 FOR TE-121.

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MAT number = 5231
 52-TE-122 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-SEP90 REV2-NOV93
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/
93-11 JENDL-3.2 WAS MADE BY JNDC FPND W.G.

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)       RESOLVED AND UNRESOLVED RESONACE PARAMETERS
      (3,102)       RE-NORMALIZED TO EXPERIMENT.
      (3,2), (3,4), (3,51-91), (3,251), (4,51-91)
                    EFFECTS OF RENORMALIZATION OF THE CAPTURE
                    CROSS SECTION.
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MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 11 KEV
       RESONANCE PARAMETERS IN THE ENERGY REGION BELOW 2.7 KEV
    WERE TAKEN FROM JENDL-3.1 WITH SLIGHT MODIFICATION AND THOSE
    ABOVE 2.7 KEV WERE NEWLY EVALUATED FOR JENDL-3.2.
       FOR JENDL-3.1, RESONANCE PARAMETERS WERE BASED ON
    MUGHABGHAB ET AL./2/  THE LEVELS ONLY WHOSE RESONANCE ENERGY
    WAS REPORTED WERE ASSUMED TO BE P-WAVE RESONANCES, AND A
    REDUCED NEUTRON WIDTH OF 23 MEV WAS TENTATIVELY GIVEN FOR
    THOSE LEVELS.  NEUTRON ORBITAL ANGULAR MOMENTUM L OF SOME
    RESONANCES WAS ESTIMATED WITH A METHOD OF BOLLINGER AND
    THOMAS/3/.  AVERAGED RADIATION WIDTH WAS DEDUCED TO BE 154
    MEV, AND APPLIED TO THE LEVELS WHOSE RADIATION WIDTH WAS
    UNKNOWN.  SCATTERING RADIUS WAS ALSO TAKEN FROM MUGHABGHAB ET
    AL.
      FOR JENDL-3.2, NEUTRON AND RADIATION WIDTH WERE DETERMINED
    FROM THE NEUTRON WIDTHS MEASURED BY TELLIER ET AL./4/ AND THE
    CAPTURE AREA DATA BY MACKLIN AND WINTERS/5/ IN THE ENERGY
    RANGE ABOVE 2.7 KEV.  THE AVERAGE RADIATION WIDTH OF 0.073 EV
    GIVEN BY MACKLIN AND WINTERS WAS APPLIED TO THE LEVELS WHOSE
    RADIATION WIDTH HAD NOT BEEN DETERMINED FROM THE EXPERIMENTS.
    THE AVERAGE VALUE OF 0.154 EV OF JENDL-3.1 WAS REPLACED WITH
    0.0733 EV.

  UNRESOLVED RESONANCE REGION : 5 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTION S0 WAS BASED ON THE COMPILATION
    OF MUGHABGHAB ET AL., AND S1 AND S2 WERE CALCULATED WITH
    OPTICAL MODEL CODE CASTHY/6/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY/6/.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH WAS BASED ON THE COMPILATION OF MUGHABGHAB
    ET AL.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.830E-4, S1 = 1.700E-4, S2 = 1.100E-4, SG = 6.67E-4,
    GG = 0.140 EV, R  = 5.490 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           5.980                     -
      ELASTIC         2.605                     -
      CAPTURE         3.375                    80.2

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/7/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING R0 AND RSO OF IIJIMA-KAWAI POTENTIAL/8/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/9/
     ALPHA    = HUIZENGA AND IGO/10/
     DEUTERON = LOHR AND HAEBERLI/11/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/12/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/13/ WERE EVALUATED BY IIJIMA ET AL./14/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
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PRESENT WORK. TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED IN THE PRESENT CALCULATION. ENERGY DEPENDENCE OF SPIN CUT-OFF PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR /15/.

MT = 1 TOTAL
SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

MT = 2 ELASTIC SCATTERING
CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

MT = 4, 51 - 91 INELASTIC SCATTERING
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR STRUCTURE DATA FILE (1987 VERSION)/16/ AND NUCLEAR DATA SHEETS/17/.

NO.	ENERGY(MEV)	SPIN-PARITY
GR.	0.0	0 +
1	0.5640	2 +
2	1.1803	4 +
3	1.2568	2 +
4	1.3570	0 +
5	1.7500	6 +

LEVELS ABOVE 1.753 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/18/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (6.36E-04) WAS ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION OF 155 MILLI-BARNS AT 90 KEV MEASURED BY MACKLIN AND WINTERS/5/.

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =106 (N,HE3) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 125.8) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/19/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,P)	10.50 MB	(RECOMMENDED BY FORREST/20/)
(N,ALPHA)	6.76 MB	(SYSTEMATICS OF FORREST/20/)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 45.97-0.199E	R0 = 6.481	A0 = 0.62
WS = 6.502	RS = 6.926	AS = 0.35
VSO= 7.0	RSO= 6.49	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
50-SN-118		1.633E+01	6.140E-01	3.341E-01	6.448E+00	2.340E+00
50-SN-119		1.635E+01	5.990E-01	1.772E+00	5.050E+00	1.190E+00
50-SN-120		1.595E+01	6.540E-01	4.691E-01	7.083E+00	2.430E+00
50-SN-121		1.630E+01	6.100E-01	2.010E+00	5.217E+00	1.190E+00
51-SB-119	*	1.858E+01	6.040E-01	5.801E+00	5.944E+00	1.150E+00
51-SB-120	*	1.834E+01	6.016E-01	3.366E+01	4.659E+00	0.0
51-SB-121		1.730E+01	5.740E-01	1.715E+00	5.022E+00	1.240E+00
51-SB-122		1.772E+01	5.500E-01	1.346E+01	3.517E+00	0.0
52-TE-120		1.700E+01	5.940E-01	3.471E-01	6.309E+00	2.290E+00
52-TE-121		1.800E+01	6.200E-01	5.720E+00	6.022E+00	1.140E+00
52-TE-122		1.705E+01	6.350E-01	6.339E-01	7.160E+00	2.380E+00
52-TE-123		1.874E+01	5.850E-01	4.619E+00	5.627E+00	1.140E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 7.524 FOR TE-122 AND 4.266 FOR TE-123.

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MAT number = 5234
 52-TE-123 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-SEP90 REV2-SEP93
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/
93-09 JENDL-3.2 WAS MADE BY JNDC FPND W.G.

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)       UNRESOLVED RESONANCE PARAMETERS RE-ADJUSTED
                    SO AS TO REPRODUCE THE RE-NORMALIZED CAPTURE
                    CROSS SECTION.
      (3,102)       RE-NORMALIZATION.
      (3,2), (3,4), (3,51-91) AND ANGULAR DISTRIBUTIONS
                    SMALL EFFECTS OF THE RE-NORMALIZATION OF
                    CAPTURE CROSS SECTION.
     **********************************************************

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 700 EV
    RESONANCE PARAMETERS WERE BASED ON MUGHABGHAB ET AL./2/ TOTAL
    SPIN J OF SOME RESONANCES WAS TENTATIVELY ESTIMATED WITH A
    RANDOM NUMBER METHOD.  NEUTRON ORBITAL ANGULAR MOMENTUM L WAS
    ESTIMATED WITH A METHOD OF BOLLINGER AND THOMAS/3/.  AVERAGED
    RADIATION WIDTH WAS DEDUCED TO BE 107 MEV, AND APPLIED TO THE
    LEVELS WHOSE RADIATION WIDTH WAS UNKNOWN.  THE SCATTERING
    RADIUS WAS ALSO TAKEN FROM MUGHABGHAB ET AL.

  UNRESOLVED RESONANCE REGION : 0.7 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTION S0 WAS BASED ON THE COMPILATION
    OF MUGHABGHAB ET AL., AND S1 AND S2 WERE CALCULATED WITH
    OPTICAL MODEL CODE CASTHY/4/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTIONS CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH GG WAS BASED ON THE COMPILATION OF
    MUGHABGHAB ET AL.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.790E-4, S1 = 1.700E-4, S2 = 1.100E-4, SG = 80.9E-4,
    GG = 0.124 EV, R  = 5.519 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL         418.7                     -
      ELASTIC         0.5894                  -
      CAPTURE       418.1                    5650
     (N,ALPHA)        4.6E-05

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/5/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING R0 AND RSO OF IIJIMA-KAWAI POTENTIAL/6/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/7/
     ALPHA    = HUIZENGA AND IGO/8/
     DEUTERON = LOHR AND HAEBERLI/9/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/10/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/11/ WERE EVALUATED BY IIJIMA ET AL./12/   MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /13/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
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    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/14/ AND NUCLEAR DATA
    SHEETS/15/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             1/2 +
            1        0.1590          3/2 +
            2        0.2475         11/2 -
            3        0.4400          3/2 +
            4        0.4897          5/2 +
            5        0.5053          3/2 +
            6        0.5996          1/2 +
            7        0.6880          3/2 +
            8        0.6975          7/2 +
            9        0.7693          5/2 +
           10        0.7836          3/2 +
           11        0.8947          3/2 +
           12        0.9961          5/2 -
           13        1.0366          3/2 +
           14        1.0682          3/2 +
           15        1.0800          7/2 +
      LEVELS ABOVE 1.21 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/16/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (7.93E-03) WAS ADJUSTED TO
    REPRODUCE THE CAPTURE CROSS SECTION OF 553 MILLI-BARNS AT 70
    KEV MEASURED BY MACKLIN ET AL./17/

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT = 32  (N,N'D) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =106  (N,HE3) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (= 149.5) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/18/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,P)         10.60  MB (SYSTEMATICS OF FORREST/19/)
      (N,ALPHA)      5.05  MB (SYSTEMATICS OF FORREST)

    THE (N,ALPHA) CROSS SECTION BELOW 0.7 KEV WAS CALCULATED FROM
    RESONANCE PARAMETERS, BY ASSUMING A MEAN ALPHA WIDTH OF
    1.15E-8 EV SO AS TO REPRODUCE THE THERMAL CROSS SECTION/2/.
    THE CROSS SECTION WAS AVERAGED IN SUITABLE ENERGY INTERVALS.
    ABOVE 0.7 KEV, THE CROSS SECTION WAS CONNECTED SMOOTHLY TO THE
    PEGASUS CALCULATION.

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
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       V  = 45.97-0.199E          R0 = 6.481    A0 = 0.62
       WS = 6.502                 RS = 6.926    AS = 0.35
       VSO= 7.0                   RSO= 6.49     ASO= 0.62
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.
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TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
50-SN-119		1.635E+01	5.990E-01	1.772E+00	5.050E+00	1.190E+00
50-SN-120		1.595E+01	6.540E-01	4.691E-01	7.083E+00	2.430E+00
50-SN-121		1.630E+01	6.100E-01	2.010E+00	5.217E+00	1.190E+00
50-SN-122		1.434E+01	7.060E-01	3.423E-01	7.416E+00	2.620E+00
51-SB-120	*	1.834E+01	6.016E-01	3.366E+01	4.659E+00	0.0
51-SB-121		1.730E+01	5.740E-01	1.715E+00	5.022E+00	1.240E+00
51-SB-122		1.772E+01	5.500E-01	1.346E+01	3.517E+00	0.0
51-SB-123		1.585E+01	6.213E-01	1.285E+00	5.469E+00	1.430E+00
52-TE-121		1.800E+01	6.200E-01	5.720E+00	6.022E+00	1.140E+00
52-TE-122		1.705E+01	6.350E-01	6.339E-01	7.160E+00	2.380E+00
52-TE-123		1.874E+01	5.850E-01	4.619E+00	5.627E+00	1.140E+00
52-TE-124		1.784E+01	6.740E-01	1.452E+00	8.479E+00	2.570E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 4.266 FOR TE-123 AND 3.991 FOR TE-124.

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MAT number = 5237

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 52-TE-124 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-SEP90 REV2-NOV93
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/
93-11 JENDL-3.2 WAS MADE BY JNDC FPND W.G.

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)       RESOLVED AND UNRESOLVED RESONACE PARAMETERS
      (3,102)       RE-NORMALIZED TO EXPERIMENT.
      (3,2), (3,4), (3,51-91), (3,251), (4,51-91)
                    EFFECTS OF RENORMALIZATION OF THE CAPTURE
                    CROSS SECTION.
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MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 7 KEV
       RESONANCE PARAMETERS IN THE ENERGY REGION BELOW 2.7 KEV
    WERE TAKEN FROM JENDL-3.1 WITH SLIGHT MODIFICATION AND THOSE
    ABOVE 2.7 KEV WERE NEWLY EVALUATED FOR JENDL-3.2.
       FOR JENDL-3.1, RESONANCE PARAMETERS WERE BASED ON
    MUGHABGHAB ET AL./2/ NEUTRON ORBITAL ANGULAR MOMENTUM L WAS
    ESTIMATED WITH A METHOD OF BOLLINGER AND THOMAS/3/.  AVERAGED
    RADIATION WIDTH OF 0.1 EV AND SCATTERING RADIUS OF 5.8 FM WERE
    TAKEN FROM MUGHABGHAB ET AL.  A NEGATIVE RESONANCE WAS ADDED
    SO AS TO REPRODUCE THE THERMAL CAPTURE AND SCATTERING CROSS
    SECTIONS GIVEN BY MUGHABGHAB ET AL.
      FOR JENDL-3.2, NEUTRON AND RADIATION WIDTH WERE DETERMINED
    FROM THE NEUTRON WIDTHS MEASURED BY TELLIER ET AL./4/ AND THE
    CAPTURE AREA DATA BY MACKLIN AND WINTERS/5/ IN THE ENERGY
    RANGE ABOVE 2.7 KEV.  THE AVERAGE RADIATION WIDTH OF 0.0635 EV
    GIVEN BY MACKLIN AND WINTERS WAS APPLIED TO THE LEVELS WHOSE
    RADIATION WIDTH HAD NOT BEEN DETERMINED FROM THE EXPERIMENTS.
    THE AVERAGE VALUE OF 0.11 EV OF JENDL-3.1 WAS REPLACED WITH
    0.0635 EV.

  UNRESOLVED RESONANCE REGION : 7 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTION S0 WAS BASED ON THE COMPILATION
    OF MUGHABGHAB ET AL./2/, AND S1 AND S2 WERE CALCULATED WITH
    OPTICAL MODEL CODE CASTHY/6/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH GG WAS BASED ON THE COMPILATION OF
    MUGHABGHAB ET AL.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.630E-4, S1 = 1.700E-4, S2 = 1.100E-4, SG = 2.79E-4,
    GG = 0.110 EV, R  = 5.648 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                    2200 M/S               RES. INTEG.
      TOTAL         10.437                     -
      ELASTIC        3.653                     -
      CAPTURE        6.785                      5.62

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/7/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING R0 AND RSO OF IIJIMA-KAWAI POTENTIAL/8/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/9/
     ALPHA    = HUIZENGA AND IGO/10/
     DEUTERON = LOHR AND HAEBERLI/11/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/12/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/13/ WERE EVALUATED BY IIJIMA ET AL./14/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
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/15/.

MT = 1 TOTAL
SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

MT = 2 ELASTIC SCATTERING
CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

MT = 4, 51 - 91 INELASTIC SCATTERING
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR STRUCTURE DATA FILE (1987 VERSION)/16/ AND NUCLEAR DATA SHEETS/17/.

NO.	ENERGY(MEV)	SPIN-PARITY
GR.	0.0	0 +
1	0.6027	2 +
2	1.1565	0 +
3	1.2486	4 +
4	1.3255	2 +
5	1.6567	0 +
6	1.7365	1 +
7	1.7462	6 +
8	1.7474	2 +
9	1.8820	0 +
10	1.9579	4 +
11	2.0200	0 +
12	2.0393	2 +
13	2.0916	2 +
14	2.1534	0 +
15	2.1825	1 -

LEVELS ABOVE 2.205 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/18/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (2.59E-04) WAS ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION OF 83.2 MILLI-BARNS AT 90 KEV MEASURED BY MACKLIN AND WINTERS/5/.

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 110.0) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/19/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,P)	9.00 MB	(RECOMMENDED BY FORREST/20/)
(N,ALPHA)	3.79 MB	(SYSTEMATICS OF FORREST/20/)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

	DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)

V = 45.97-0.199E   R0 = 6.481   A0 = 0.62
WS = 6.502   RS = 6.926   AS = 0.35
VSO= 7.0   RSO= 6.49   ASO= 0.62
THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
50-SN-120	1.595E+01	6.540E-01	4.691E-01	7.083E+00	2.430E+00
50-SN-121	1.630E+01	6.100E-01	2.010E+00	5.217E+00	1.190E+00
50-SN-122	1.434E+01	7.060E-01	3.423E-01	7.416E+00	2.620E+00
50-SN-123	1.509E+01	6.870E-01	3.062E+00	6.032E+00	1.190E+00
51-SB-121	1.730E+01	5.740E-01	1.715E+00	5.022E+00	1.240E+00
51-SB-122	1.772E+01	5.500E-01	1.346E+01	3.517E+00	0.0
51-SB-123	1.585E+01	6.213E-01	1.285E+00	5.469E+00	1.430E+00
51-SB-124	1.696E+01	5.600E-01	1.090E+01	3.433E+00	0.0
52-TE-122	1.705E+01	6.350E-01	6.339E-01	7.160E+00	2.380E+00
52-TE-123	1.874E+01	5.850E-01	4.619E+00	5.627E+00	1.140E+00
52-TE-124	1.784E+01	6.740E-01	1.452E+00	8.479E+00	2.570E+00
52-TE-125	1.992E+01	5.590E-01	5.035E+00	5.527E+00	1.140E+00

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 3.991 FOR TE-124 AND 10.14 FOR TE-125.

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MAT number = 5240

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 52-TE-125 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-SEP90 REV2-NOV93
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/
93-11 JENDL-3.2 WAS MADE BY JNDC FPND W.G.

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)       RESOLVED RESONACE PARAMETERS
     ***********************************************************


MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 3 KEV
       RESONANCE PARAMETERS IN THE ENERGY REGION BELOW 2.7 KEV
    WERE TAKEN FROM JENDL-3.1 WITH SLIGHT MODIFICATION AND THOSE
    ABOVE 2.7 KEV WERE NEWLY EVALUATED FOR JENDL-3.2.
       FOR JENDL-3.1, RESONANCE PARAMETERS WERE BASED ON
    MUGHABGHAB ET AL./2/ TOTAL SPIN J OF SOME RESONANCES WAS TEN-
    TATIVELY ESTIMATED WITH A RANDOM NUMBER METHOD.  NEUTRON
    ORBITAL ANGULAR MOMENTUM L WAS ESTIMATED WITH A METHOD OF
    BOLLINGER AND THOMAS/3/.  AVERAGED RADIATION WIDTH WAS DEDUCED
    TO BE 150 MEV, AND APPLIED TO THE LEVELS WHOSE RADIATION WIDTH
    WAS UNKNOWN.  A NEGATIVE RESONANCE WAS ADDED AND ITS PARAME-
    TERS WERE ADJUSTED TOGETHER WITH SCATTERING RADIUS (6.0 FM) SO
    AS TO REPRODUCE THE THERMAL CAPTURE AND SCATTERING CROSS
    SECTIONS GIVEN BY MUGHABGHAB ET AL.
      FOR JENDL-3.2, NEUTRON AND RADIATION WIDTH WERE DETERMINED
    FROM THE NEUTRON WIDTHS MEASURED BY TELLIER ET AL./4/ AND THE
    CAPTURE AREA DATA BY MACKLIN AND WINTERS/5/ IN THE ENERGY
    RANGE ABOVE 2.7 KEV.  THE AVERAGE RADIATION WIDTH OF 0.1075 EV
    GIVEN BY MACKLIN AND WINTERS WAS APPLIED TO THE LEVELS WHOSE
    RADIATION WIDTH HAD NOT BEEN DETERMINED FROM THE EXPERIMENTS.
    THE AVERAGE VALUE OF 0.15 EV OF JENDL-3.1 WAS REPLACED WITH
    0.1075 EV.

  UNRESOLVED RESONANCE REGION : 3 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTION S0 WAS BASED ON THE COMPILATION
    OF MUGHABGHAB ET AL., AND S1 AND S2 WERE CALCULATED WITH
    OPTICAL MODEL CODE CASTHY/6/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH GG WAS BASED ON THE COMPILATION OF
    MUGHABGHAB ET AL.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.480E-4, S1 = 1.700E-4, S2 = 1.000E-4, SG = 33.9E-4,
    GG = 0.157 EV, R  = 5.761 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                      2200 M/S                RES. INTEG.
      TOTAL            4.940                    -
      ELASTIC          3.420                    -
      CAPTURE          1.520                   21.9

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/7/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING R0 AND RSO OF IIJIMA-KAWAI POTENTIAL/8/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/9/
     ALPHA    = HUIZENGA AND IGO/10/
     DEUTERON = LOHR AND HAEBERLI/11/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/12/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/13/ WERE EVALUATED BY IIJIMA ET AL./14/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /15/.
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MT = 1  TOTAL
  SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

MT = 2  ELASTIC SCATTERING
  CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

MT = 4, 51 - 91  INELASTIC SCATTERING
  SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
  ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
  STRUCTURE DATA FILE (1987 VERSION)/16/ AND NUCLEAR DATA
  SHEETS/17/.

         NO.      ENERGY(MEV)    SPIN-PARITY
         GR.       0.0             1/2 +
          1        0.0355          3/2 +
          2        0.1448         11/2 -
          3        0.3211          9/2 -
          4        0.4435          3/2 +
          5        0.4634          5/2 +
          6        0.5252          7/2 -
          7        0.6360          7/2 +
          8        0.6421          7/2 +
          9        0.6714          5/2 +
         10        0.7293          3/2 +
         11        0.8040         15/2 -
         12        0.8408         15/2 -
         13        1.0170         11/2 -
         14        1.0550          5/2 -
         15        1.1330          3/2 +
         16        1.1917          9/2 +
         17        1.2650          3/2 +
    LEVELS ABOVE 1.31 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102  CAPTURE
  SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
  CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
  SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
  AND REFFO/18/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

  THE GAMMA-RAY STRENGTH FUNCTION (3.28E-03) WAS ADJUSTED TO
  REPRODUCE THE CAPTURE CROSS SECTION OF 600 MILLI-BARNS AT 20
  KEV MEASURED BY BERGMAN AND ROMANOV/19/

MT = 16  (N,2N) CROSS SECTION
MT = 17  (N,3N) CROSS SECTION
MT = 22  (N,N'A) CROSS SECTION
MT = 28  (N,N'P) CROSS SECTION
MT = 32  (N,N'D) CROSS SECTION
MT =103  (N,P) CROSS SECTION
MT =104  (N,D) CROSS SECTION
MT =105  (N,T) CROSS SECTION
MT =107  (N,ALPHA) CROSS SECTION
  THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
  PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

  THE KALBACH'S CONSTANT K (= 179.3) WAS ESTIMATED BY THE
  FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/20/ AND LEVEL
  DENSITY PARAMETERS.

  FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
  NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
    (N,P)          5.70  MB (SYSTEMATICS OF FORREST/21/)
    (N,ALPHA)      2.86  MB (SYSTEMATICS OF FORREST)

MT = 251  MU-BAR
  CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS
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	DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
	V = 45.97-0.199E	R0 = 6.481	A0 = 0.62
	WS = 6.502	RS = 6.926	AS = 0.35
	VSO= 7.0	RSO= 6.49	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
50-SN-121	1.630E+01	6.100E-01	2.010E+00	5.217E+00	1.190E+00
50-SN-122	1.434E+01	7.060E-01	3.423E-01	7.416E+00	2.620E+00
50-SN-123	1.509E+01	6.870E-01	3.062E+00	6.032E+00	1.190E+00
50-SN-124	1.601E+01	6.160E-01	3.224E-01	6.294E+00	2.280E+00
51-SB-122	1.772E+01	5.500E-01	1.346E+01	3.517E+00	0.0
51-SB-123	1.585E+01	6.213E-01	1.285E+00	5.469E+00	1.430E+00
51-SB-124	1.696E+01	5.600E-01	1.090E+01	3.433E+00	0.0
51-SB-125	1.700E+01	5.120E-01	7.883E-01	3.792E+00	1.090E+00
52-TE-123	1.874E+01	5.850E-01	4.619E+00	5.627E+00	1.140E+00
52-TE-124	1.784E+01	6.740E-01	1.452E+00	8.479E+00	2.570E+00
52-TE-125	1.992E+01	5.590E-01	5.035E+00	5.527E+00	1.140E+00
52-TE-126	1.706E+01	6.100E-01	5.154E-01	6.554E+00	2.230E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 10.14 FOR TE-125 AND 7.509 FOR TE-126.

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20) KIKUCHI, K. AND KAWAI, M.: "NUCLEAR MATTER AND NUCLEAR REACTIONS", NORTH HOLLAND (1968).
21) FORREST, R.A.: AERE-R 12419 (1986).

MAT number = 5243

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 52-TE-126 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-SEP90 REV2-NOV93
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/
93-11 JENDL-3.2 WAS MADE BY JNDC FPND W.G.

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)       RESOLVED RESONACE PARAMETERS
     ***********************************************************


MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 14.7 KEV
       RESONANCE PARAMETERS IN THE ENERGY REGION BELOW 2.7 KEV
    WERE TAKEN FROM JENDL-3.1 WITH SLIGHT MODIFICATION AND THOSE
    ABOVE 2.7 KEV WERE NEWLY EVALUATED FOR JENDL-3.2.
       FOR JENDL-3.1, RESONANCE PARAMETERS WERE BASED ON
    MUGHABGHAB ET AL./2/  THE LEVELS WHOSE NEUTRON WIDTH WAS
    UNKNOWN WERE ASSUMED TO BE P-WAVE RESONANCES AND A REDUCED
    NEUTRON WIDTH OF 35 MEV WAS TENTATIVELY GIVEN FOR THOSE
    LEVELS.  NEUTRON ORBITAL ANGULAR MOMENTUM L OF SOME RESONANCES
    WAS ESTIMATED WITH A METHOD OF BOLLINGER AND THOMAS/3/.
    AVERAGED RADIATION WIDTH WAS DEDUCED TO BE 98 MEV AND APPLIED
    TO THE LEVELS WHOSE RADIATION WIDTH WAS UNKNOWN.  THE SCATTER-
    ING RADIUS OF 5.6 FM WAS TAKEN FROM MUGHABGHAB ET AL./2/  A
    NEGATIVE RESONANCE WAS ADDED SO AS TO REPRODUCE THE THERMAL
    CAPTURE CROSS SECTION GIVEN BY MUGHABGHAB ET AL.
      FOR JENDL-3.2, NEUTRON AND RADIATION WIDTH WERE DETERMINED
    FROM THE NEUTRON WIDTHS MEASURED BY TELLIER ET AL./4/ AND THE
    CAPTURE AREA DATA BY MACKLIN AND WINTERS/5/ IN THE ENERGY
    RANGE ABOVE 2.7 KEV.  THE AVERAGE RADIATION WIDTH OF 0.070 EV
    GIVEN BY MACKLIN AND WINTERS WAS APPLIED TO THE S-WAVE
    RESONANCES WHOSE RADIATION WIDTH HAD NOT BEEN DETERMINED FROM
    THE EXPERIMENTS.  FOR THE P-WAVE RESONANCES WITHOUT KNOWN
    RADIATION WIDTH, THE VALUE OF 0.100 EV WAS ASSUMED.

  UNRESOLVED RESONANCE REGION : 14.7 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTION S0 WAS BASED ON THE COMPILATION
    OF MUGHABGHAB ET AL./2/, AND S1 AND S2 WERE CALCULATED WITH
    OPTICAL MODEL CODE CASTHY/6/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS OF
    MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.280E-4, S1 = 1.700E-4, S2 = 1.000E-4, SG = 1.41E-4,
    GG = 0.150 EV, R  = 5.891 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           4.572                   -
      ELASTIC         3.537                   -
      CAPTURE         1.035                    8.15

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/7/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING R0 AND RSO OF IIJIMA-KAWAI POTENTIAL/8/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/9/
     ALPHA    = HUIZENGA AND IGO/10/
     DEUTERON = LOHR AND HAEBERLI/11/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/12/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/13/ WERE EVALUATED BY IIJIMA ET AL./14/   MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
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/15/.

MT = 1  TOTAL
  SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

MT = 2  ELASTIC SCATTERING
  CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

MT = 4, 51 - 91  INELASTIC SCATTERING
  SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
  ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
  STRUCTURE DATA FILE (1987 VERSION)/16/ AND NUCLEAR DATA
  SHEETS/17/.

         NO.       ENERGY(MEV)    SPIN-PARITY
         GR.        0.0             0  +
          1         0.6663          2  +
          2         1.3613          4  +
          3         1.4202          2  +
          4         1.7755          6  +
          5         1.8735          0  +
          6         2.0133          4  +
          7         2.0453          2  +
          8         2.1816          1  -
          9         2.2176          5  -
         10         2.3094          2  +
         11         2.3861          3  -
         12         2.3960          5  +
         13         2.4213          3  -
    LEVELS ABOVE 2.44 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102  CAPTURE
  SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
  CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
  SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
  AND REFFO/18/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

  THE GAMMA-RAY STRENGTH FUNCTION (1.26E-04) WAS ADJUSTED TO
  REPRODUCE THE CAPTURE CROSS SECTION OF 68 MILLI-BARNS AT 40
  KEV MEASURED BY BERGMAN AND ROMANOV/19/

MT = 16  (N,2N) CROSS SECTION
MT = 17  (N,3N) CROSS SECTION
MT = 22  (N,N'A) CROSS SECTION
MT = 28  (N,N'P) CROSS SECTION
MT =103  (N,P) CROSS SECTION
MT =104  (N,D) CROSS SECTION
MT =105  (N,T) CROSS SECTION
MT =107  (N,ALPHA) CROSS SECTION
  THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
  PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

  THE KALBACH'S CONSTANT K (= 113.3) WAS ESTIMATED BY THE
  FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/20/ AND LEVEL
  DENSITY PARAMETERS.

  FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
  NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
    (N,P)           5.00  MB (RECOMMENDED BY FORREST/21/)
    (N,ALPHA)       2.30  MB (RECOMMENDED BY FORREST)

MT = 251  MU-BAR
  CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
          ----------------------  ------------  ---------------
          V  = 45.97-0.199E       R0 = 6.481    A0 = 0.62
          WS = 6.502              RS = 6.926    AS = 0.35
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VSO= 7.0 RSO= 6.49 ASO= 0.62
THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
50-SN-122	1.434E+01	7.060E-01	3.423E-01	7.416E+00	2.620E+00
50-SN-123	1.509E+01	6.870E-01	3.062E+00	6.032E+00	1.190E+00
50-SN-124	1.601E+01	6.160E-01	3.224E-01	6.294E+00	2.280E+00
50-SN-125	1.591E+01	6.210E-01	1.927E+00	5.249E+00	1.190E+00
51-SB-123	1.585E+01	6.213E-01	1.285E+00	5.469E+00	1.430E+00
51-SB-124	1.696E+01	5.600E-01	1.090E+01	3.433E+00	0.0
51-SB-125	1.700E+01	5.120E-01	7.883E-01	3.792E+00	1.090E+00
51-SB-126	1.700E+01	5.250E-01	7.566E+00	2.897E+00	0.0
52-TE-124	1.784E+01	6.740E-01	1.452E+00	8.479E+00	2.570E+00
52-TE-125	1.992E+01	5.590E-01	5.035E+00	5.527E+00	1.140E+00
52-TE-126	1.706E+01	6.100E-01	5.154E-01	6.554E+00	2.230E+00
52-TE-127	2.004E+01	5.380E-01	3.633E+00	5.165E+00	1.140E+00

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 7.509 FOR TE-126 AND 6.066 FOR TE-127.

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MAT number = 5247

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 52-TE-127MJNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  NO RESOLVED RESONANCE PARAMETERS

  UNRESOLVED RESONANCE REGION : 5.3 EV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/2/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.  THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS
    OF MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.980E-4, S1 = 1.700E-4, S2 = 1.000E-4, SG = 130.E-4,
    GG = 0.150 EV, R  = 5.352 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
    TOTAL          3384                        -
    ELASTIC           3.630                    -
    CAPTURE        3380                      1340

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 5.3 EV, THE CAPTURE AND ELASTIC SCATTERING CROSS SECTIONS
  WERE ASSUMED TO BE IN 1/V FORM AND CONSTANT, RESPECTIVELY.
  THE CAPTURE CROSS SECTION AT 0.0253 EV WAS TAKEN FROM REF./3/.
  UNRESOLVED RESONANCE PARAMETERS WERE GIVEN IN THE ENERGY RANGE
  FROM 5.3 EV TO 100 KEV.

  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/4/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING R0 AND RSO OF IIJIMA-KAWAI POTENTIAL/5/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/6/
     ALPHA    = HUIZENGA AND IGO/7/
     DEUTERON = LOHR AND HAEBERLI/8/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/9/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/10/ WERE EVALUATED BY IIJIMA ET AL./11/.  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /12/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/13/ AND NUCLEAR DATA
    SHEETS/14/.

            NO.      ENERGY(MEV)    SPIN-PARITY
            GR.       0.0           11/2 -
             1       -.08826         3/2 +
             2       -.02714         1/2 +
             3        0.2518         9/2 -
             4        0.3850         5/2 +
             5        0.4146         3/2 +
             6        0.5426         7/2 -
             7        0.5477         1/2 +
             8        0.5972         5/2 +
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          9        0.6754         3/2 +
         10        0.6951         5/2 +
         11        0.6969         9/2 -
         12        0.8359         7/2 +
         13        0.9887         5/2 +
         14        1.0526         5/2 +
         15        1.0671         5/2 +
      LEVELS ABOVE 1.088 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/15/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (1.32E-02) WAS DETERMINED FROM
    THE SYSTEMATICS OF RADIATION WIDTH (0.14 EV) AND THE AVERAGE
    S-WAVE RESONANCE LEVEL SPACING (10.6 EV) CALCULATED FROM THE
    LEVEL DENSITY PARAMETERS.

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT = 32  (N,N'D) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (= 160.0) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/16/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,P)          3.07  MB (SYSTEMATICS OF FORREST/17/)
      (N,ALPHA)      1.65  MB (SYSTEMATICS OF FORREST)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY/2/.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTR1-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.
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TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

	DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V	= 45.97-0.199E	R0 = 6.481	A0 = 0.62
WS	= 6.502	RS = 6.926	AS = 0.35
VSO	= 7.0	RSO= 6.49	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
50-SN-123	1.509E+01	6.870E-01	3.062E+00	6.032E+00	1.190E+00
50-SN-124	1.601E+01	6.160E-01	3.224E-01	6.294E+00	2.280E+00
50-SN-125	1.591E+01	6.210E-01	1.927E+00	5.249E+00	1.190E+00
50-SN-126	1.646E+01	6.270E-01	4.012E-01	6.778E+00	2.390E+00
51-SB-124	1.696E+01	5.600E-01	1.090E+01	3.433E+00	0.0
51-SB-125	1.700E+01	5.120E-01	7.883E-01	3.792E+00	1.090E+00
51-SB-126	1.700E+01	5.250E-01	7.566E+00	2.897E+00	0.0
51-SB-127	1.700E+01	5.120E-01	6.326E-01	3.902E+00	1.200E+00
52-TE-125	1.992E+01	5.590E-01	5.035E+00	5.527E+00	1.140E+00
52-TE-126	1.706E+01	6.100E-01	5.154E-01	6.554E+00	2.230E+00
52-TE-127	2.004E+01	5.380E-01	3.633E+00	5.165E+00	1.140E+00

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52-TE-128     1.800E+01 6.090E-01 6.586E-01 7.010E+00 2.340E+00
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SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 6.066 FOR TE-127 AND 7.680 FOR TE-128.

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MAT number = 5249
 52-TE-128 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 8 KEV
    RESONANCE PARAMETERS WERE TAKEN FROM JENDL-2./1/
    EVALUATION FOR JENDL-2 WAS MADE BY KIKUCHI/3/.  NEUTRON WIDTHS
    WERE ADOPTED FROM EXPERIMENTAL DATA OF TELLIER ET AL./4/, AND
    RADIATIVE CAPTURE WIDTHS FROM CAPTURE AREAS MEASURED BY BROWNE
    AND BERMAN/5/.  FOR THE RESONANCES ABOVE 7 KEV, THE AVERAGE
    RADIATION WIDTH OF 0.048+-0.025 EV WAS ASSUMED.  A NEGATIVE
    RESONANCE WAS ADDED AT -600 EV SO AS TO REPRODUCE THE THERMAL
    CAPTURE CROSS SECTION OF 0.215+-0.008 BARNS/6/.  THE EFFECTIVE
    SCATTERING RADIUS OF 5.5 FM WAS TAKEN FROM REF./6/.

  UNRESOLVED RESONANCE REGION : 8 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTION S0 WAS BASED ON THE COMPILATION
    OF MUGHABGHAB ET AL./6/, AND S1 AND S2 WERE CALCULATED WITH
    OPTICAL MODEL CODE CASTHY/7/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS OF
    MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.250E-4, S1 = 1.700E-4, S2 = 1.000E-4, SG = 0.540E-4,
    GG = 0.150 EV, R  = 5.897 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           4.313                    -
      ELASTIC         4.099                    -
      CAPTURE         0.2140                    1.31

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/8/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING R0 AND RS0 OF IIJIMA-KAWAI POTENTIAL/9/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/10/
     ALPHA    = HUIZENGA AND IGO/11/
     DEUTERON = LOHR AND HAEBERLI/12/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/13/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/14/ WERE EVALUATED BY IIJIMA ET AL./15/   MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /16/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./17/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             0  +
            1        0.7432          2  +
            2        1.4971          4  +
            3        1.5232          2  +
            4        1.8111          6  +
            5        1.9722          2  +
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          6        1.9822          0  +
          7        2.0300          4  +
          8        2.1320          2  +
          9        2.1335          5  -
      LEVELS ABOVE 2.197 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/18/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (4.85E-05) WAS ADJUSTED TO
    REPRODUCE THE CAPTURE CROSS SECTION OF 48 MILLI-BARNS AT 20
    KEV MEASURED BY BERGMAN AND ROMANOV/19/.

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (= 116.8) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/20/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,P)           2.40  MB (RECOMMENDED BY FORREST/21/)
      (N,ALPHA)       0.95  MB (RECOMMENDED BY FORREST)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY/7/.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

              DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
         ----------------------  ------------  ---------------
        V  = 45.97-0.199E        R0 = 6.481    A0 = 0.62
        WS = 6.502               RS = 6.926    AS = 0.35
        VSO= 7.0                 RSO= 6.49     ASO= 0.62
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2  LEVEL DENSITY PARAMETERS

 NUCLIDE       A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
 ---------------------------------------------------------------
 50-SN-124     1.601E+01 6.160E-01 3.224E-01 6.294E+00 2.280E+00
 50-SN-125     1.591E+01 6.210E-01 1.927E+00 5.249E+00 1.190E+00
 50-SN-126     1.646E+01 6.270E-01 4.012E-01 6.778E+00 2.390E+00
 50-SN-127     1.577E+01 6.140E-01 1.633E+00 5.075E+00 1.190E+00

 51-SB-125     1.700E+01 5.120E-01 7.883E-01 3.792E+00 1.090E+00
 51-SB-126     1.700E+01 5.250E-01 7.566E+00 2.897E+00 0.0
 51-SB-127     1.700E+01 5.120E-01 6.326E-01 3.902E+00 1.200E+00
 51-SB-128     1.468E+01 5.600E-01 4.264E+00 2.658E+00 0.0

 52-TE-126     1.706E+01 6.100E-01 5.154E-01 6.554E+00 2.230E+00
 52-TE-127     2.004E+01 5.380E-01 3.633E+00 5.165E+00 1.140E+00
 52-TE-128     1.800E+01 6.090E-01 6.586E-01 7.010E+00 2.340E+00
 52-TE-129     2.015E+01 5.350E-01 3.588E+00 5.141E+00 1.140E+00
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 SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
 IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
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ASSUMED TO BE 7.680 FOR TE-128 AND 5.913 FOR TE-129.

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MAT number = 5253

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 52-TE-129MJNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  NO RESOLVED RESONANCE PARAMETERS

  UNRESOLVED RESONANCE REGION : 7.2 EV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/2/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.  THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS
    OF MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.980E-4, S1 = 1.600E-4, S2 = 1.000E-4, SG = 99.2E-4,
    GG = 0.140 EV, R  = 5.407 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL        1603                         -
      ELASTIC         3.400                     -
      CAPTURE      1600                       752

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 7.2 EV, THE CAPTURE AND ELASTIC SCATTERING CROSS SECTIONS
  WERE ASSUMED TO BE IN 1/V FORM AND CONSTANT, RESPECTIVELY.
  THE CAPTURE CROSS SECTION AT 0.0253 EV WAS DETERMINED BY THE
  SYSTEMATICS FROM NEIGHBORING TE ISOTOPES.  THE ELASTIC
  SCATTERING CROSS SECTION WAS ESTIMATED FROM R = 5.2 FM.
  UNRESOLVED RESONANCE PARAMETERS WERE GIVEN IN THE ENERGY RANGE
  FROM 7.2 EV TO 100 KEV.

  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY/2/, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/3/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING RO AND RSO OF IIJIMA-KAWAI POTENTIAL/4/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/5/
     ALPHA    = HUIZENGA AND IGO/6/
     DEUTERON = LOHR AND HAEBERLI/7/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/8/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/9/ WERE EVALUATED BY IIJIMA ET AL./10/.  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /11/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/12/ AND NUCLEAR DATA
    SHEETS/13/.
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NO.	ENERGY(MEV)	SPIN-PARITY
GR.	0.0	11/2 -
1	-0.1055	3/2 +
2	0.0753	1/2 +
3	0.3595	9/2 +
4	0.4392	5/2 +
5	0.5284	5/2 +
6	0.6546	7/2 -

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             7        0.7073         7/2 +
             8        0.7705         5/2 -
             9        0.8610         5/2 +
            10        1.0495         1/2 +
            11        1.1045         7/2 +
            12        1.1227         7/2 -
            13        1.1753         5/2 +
            14        1.1965         7/2 +
            15        1.2120         5/2 +
            16        1.3295         3/2 +
            17        1.4525         1/2 -
            18        1.4932         1/2 -
            19        1.5275         9/2 +
            20        1.5485         1/2 +
            21        1.5491         5/2 +
            22        1.6218         9/2 +
            23        1.6469         5/2 +
       LEVELS ABOVE 1.675 MEV WERE ASSUMED TO BE OVERLAPPING.

   MT = 102  CAPTURE
     SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
     CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
     SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
     AND REFFO/14/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

     THE GAMMA-RAY STRENGTH FUNCTION (9.71E-03) WAS DETERMINED FROM
     THE SYSTEMATICS OF RADIATION WIDTH (0.14 EV) AND THE AVERAGE
     S-WAVE RESONANCE LEVEL SPACING (14.4 EV) CALCULATED FROM THE
     LEVEL DENSITY PARAMETERS.

   MT = 16  (N,2N) CROSS SECTION
   MT = 17  (N,3N) CROSS SECTION
   MT = 22  (N,N'A) CROSS SECTION
   MT = 28  (N,N'P) CROSS SECTION
   MT = 32  (N,N'D) CROSS SECTION
   MT =103  (N,P) CROSS SECTION
   MT =104  (N,D) CROSS SECTION
   MT =105  (N,T) CROSS SECTION
   MT =107  (N,ALPHA) CROSS SECTION
     THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
     PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

     THE KALBACH'S CONSTANT K (= 167.7) WAS ESTIMATED BY THE
     FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/15/ AND LEVEL
     DENSITY PARAMETERS.

     FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
     NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
       (N,P)          1.66  MB (SYSTEMATICS OF FORREST/16/)
       (N,ALPHA)      0.96  MB (SYSTEMATICS OF FORREST)

   MT = 251  MU-BAR
     CALCULATED WITH CASTHY.

 MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
   LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
   GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
   TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
   CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
   BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

 MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
   ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
   PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
   OTHER NEUTRON EMITTING REACTIONS.

 TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                 DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
           ----------------------  ------------  ---------------
          V  = 45.97-0.199E        R0 = 6.481    A0 = 0.62
          WS = 6.502               RS = 6.926    AS = 0.35
          VSO= 7.0                 RSO= 6.49     ASO= 0.62
   THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

 TABLE 2  LEVEL DENSITY PARAMETERS

  NUCLIDE   SYST A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
  ---------------------------------------------------------------
  50-SN-125      1.591E+01 6.210E-01 1.927E+00 5.249E+00 1.190E+00
  50-SN-126      1.646E+01 6.270E-01 4.012E-01 6.778E+00 2.390E+00
  50-SN-127      1.577E+01 6.140E-01 1.633E+00 5.075E+00 1.190E+00
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50-SN-128   *   1.584E+01 5.822E-01 1.831E-01 5.627E+00 2.230E+00

51-SB-126       1.700E+01 5.250E-01 7.566E+00 2.897E+00 0.0
51-SB-127       1.700E+01 5.120E-01 6.326E-01 3.902E+00 1.200E+00
51-SB-128       1.468E+01 5.600E-01 4.264E+00 2.658E+00 0.0
51-SB-129       1.596E+01 5.040E-01 5.308E-01 3.333E+00 1.040E+00

52-TE-127       2.004E+01 5.380E-01 3.633E+00 5.165E+00 1.140E+00
52-TE-128       1.800E+01 6.090E-01 6.586E-01 7.010E+00 2.340E+00
52-TE-129       2.015E+01 5.350E-01 3.588E+00 5.141E+00 1.140E+00
52-TE-130       1.800E+01 5.470E-01 2.657E-01 5.735E+00 2.180E+00
-----------------------------------------------------------------
 SYST:  * = LDP'S WERE DETERMINED FROM SYSTEMATICS.
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SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 5.913 FOR TE-129 AND 12.98 FOR TE-130.

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MAT number = 5255

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 52-TE-130 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 30.5 KEV
    RESONANCE PARAMETERS WERE MAINLY BASED ON MUGHABGHAB ET AL./2/
    SOME RADIATION WIDTHS WERE DERIVED FROM THE DATA OF CAPTURE
    AREA AND NEUTRON WIDTH GIVEN BY MUGHABGHAB ET AL.  NEUTRON
    ORBITAL ANGULAR MOMENTUM L WAS ESTIMATED WITH A METHOD OF
    BOLLINGER AND THOMAS/3/.  AVERAGED RADIATION WIDTH WAS DEDUCED
    TO BE 107 MEV, AND APPLIED TO THE LEVELS WHOSE RADIATION WIDTH
    WAS UNKNOWN.  THE SCATTERING RADIUS OF 7.4 FM WAS TAKEN FROM
    MUGHABGHAB ET AL.  A NEGATIVE RESONANCE WAS ADDED SO AS TO
    REPRODUCE THE THERMAL CAPTURE CROSS SECTION GIVEN BY
    MUGHABGHAB ET AL.

  UNRESOLVED RESONANCE REGION : 30.5 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTION S0 WAS BASED ON THE COMPILATION
    OF MUGHABGHAB ET AL., AND S1 AND S2 WERE CALCULATED WITH
    OPTICAL MODEL CODE CASTHY/4/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS OF
    MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.160E-4, S1 = 1.600E-4, S2 = 0.990E-4, SG = 0.157E-4,
    GG = 0.130 EV, R  = 6.013 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S                RES. INTEG.
      TOTAL          4.106                     -
      ELASTIC        3.836                     -
      CAPTURE        0.2700                     0.285

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/5/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING R0 AND RSO OF IIJIMA-KAWAI POTENTIAL/6/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/7/
     ALPHA    = HUIZENGA AND IGO/8/
     DEUTERON = LOHR AND HAEBERLI/9/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/10/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/11/ WERE EVALUATED BY IIJIMA ET AL./12/   MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /13/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/14/ AND NUCLEAR DATA
    SHEETS/15/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             0  +
            1        0.8394          2  +
            2        1.5880          2  +
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             3        1.6328          4  +
             4        1.8150          6  +
             5        1.9814          4  +
             6        2.1008          5  -
             7        2.1460          7  -
      LEVELS ABOVE 2.191 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/16/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (1.41E-05) WAS ADJUSTED TO
    REPRODUCE THE CAPTURE CROSS SECTION OF 11 MILLI-BARNS AT 60
    KEV MEASURED BY BERGMAN AND ROMANOV/17/.

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE
    PEGASUS.

    THE KALBACH'S CONSTANT K (= 159.1) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/18/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,P) CROSS SECTIONS WAS NORMALIZED TO THE
    FOLLOWING VALUE AT 14.5 MEV:
      (N,P)          1.80  MB (RECOMMENDED BY FORREST/19/)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                 DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
          ----------------------   ------------  ---------------
         V  = 45.97-0.199E         R0 = 6.481    A0 = 0.62
         WS = 6.502                RS = 6.926    AS = 0.35
         VSO= 7.0                  RSO= 6.49     ASO= 0.62
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2  LEVEL DENSITY PARAMETERS

 NUCLIDE   SYST A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
 ---------------------------------------------------------------
 50-SN-126      1.646E+01 6.270E-01 4.012E-01 6.778E+00 2.390E+00
 50-SN-127      1.577E+01 6.140E-01 1.633E+00 5.075E+00 1.190E+00
 50-SN-128   *  1.584E+01 5.822E-01 1.831E-01 5.627E+00 2.230E+00
 50-SN-129   *  1.554E+01 5.798E-01 9.299E-01 4.443E+00 1.190E+00

 51-SB-127      1.700E+01 5.120E-01 6.326E-01 3.902E+00 1.200E+00
 51-SB-128      1.468E+01 5.600E-01 4.264E+00 2.658E+00 0.0
 51-SB-129      1.596E+01 5.040E-01 5.308E-01 3.333E+00 1.040E+00
 51-SB-130      1.566E+01 5.000E-01 3.630E+00 2.154E+00 0.0

 52-TE-128      1.800E+01 6.090E-01 6.586E-01 7.010E+00 2.340E+00
 52-TE-129      2.015E+01 5.350E-01 3.588E+00 5.141E+00 1.140E+00
 52-TE-130      1.800E+01 5.470E-01 2.657E-01 5.735E+00 2.180E+00
 52-TE-131      1.846E+01 5.360E-01 1.800E+00 4.651E+00 1.140E+00
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  SYST:  * = LDP'S WERE DETERMINED FROM SYSTEMATICS.
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SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 12.98 FOR TE-130 AND 5.0 FOR TE-131.

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MAT number = 5325

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 53-I -127 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-SEP90 REV2-APR93
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.
93-09 JENDL-3.2 WAS MADE BY JNDC FPND W.G.

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)      UPPER BOUNDARY OF RESOLVED RESONANCE REGION
                   WAS CHANGED FROM 4.252 KEV TO 2 KEV.
     ***********************************************************


MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 2.0 KEV
    RESONANCE PARAMETERS OF JENDL-2 WERE MODIFIED AS FOLLOWS:
    EVALUATION FOR JENDL-2 WAS CARRIED OUT ON THE BASIS OF THE
    MEASUREMENTS BY GARG ET AL./3/, CAUVIN ET AL./4/, ROHR ET
    AL./5/, AND MACKLIN/6/.  RESONANCE ENERGIES WERE BASED ON THE
    DATA BY GARG ET AL. (64 LEVELS), BY ROHR ET AL. (190 LEVELS),
    AND BY MACKLIN (119 LEVELS).  NEUTRON WIDTHS WERE DERIVED FROM
    THE DATA OF 2G*(REDUCED NEUTRON WIDTH) BY GARG ET AL., THOSE
    OF 2G*(NEUTRON WIDTH) BY ROHR ET AL., AND THOSE OF G*(NEUTRON
    WIDTH) AND NEUTRON CAPTURE AREAS BY MACKLIN.  RADIATION WIDTHS
    WERE DERIVED FROM THE DATA OF 2G*(RADIATION WIDTH) BY ROHR ET
    AL. AND FROM THOSE OF (72/37)*G*(RADIATION WIDTH) BY MACKLIN.
    AVERAGE RADIATION WIDTH OF 83.24 MEV OBTAINED BY AVERAGING THE
    DATA BY ROHR ET AL., AND THAT OF 110 MEV GIVEN BY MACKLIN WERE
    ADOPTED IN THE ENERGY REGIONS BELOW AND ABOVE 2650 EV,
    RESPECTIVELY.  THE DATA OF TOTAL SPIN J MEASURED BY CAUVIN ET
    AL. WERE AVAILABLE FOR THE 13 RESONANCE LEVELS BELOW 240 EV.
    AS FOR THE REMAINING 360 LEVELS, TARGET SPIN OF 2.5 WAS
    ADOPTED AS TOTAL SPIN.  TWO NEGATIVE RESONANCES WERE ADDED SO
    AS TO REPRODUCE THE THERMAL CAPTURE AND SCATTERING CROSS
    SECTIONS OF 6.2+-0.2 AND 3.54+-0.03 BARNS/7/, RESPECTIVELY.
    SCATTERING RADIUS WAS ALSO TAKEN FROM MUGHABGHAB ET AL./7/

    FOR JENDL-3, THE VALUES OF TOTAL SPIN J FOR THE 360 RESONANCE
    LEVELS MENTIONED ABOVE WERE TENTATIVELY ESTIMATED WITH A
    RANDOM NUMBER METHOD.  NEUTRON AND RADIATION WIDTHS WERE
    MODIFIED ON THE BASIS OF THE ESTIMATED J-VALUES.  A RESONANCE
    LEVEL MEASURED BY POPOV AND TSHETSYAK/8/ WAS ADDED AT 137.0
    EV, AND AVERAGE RADIATION WIDTHS OF THE 20.41-, 65.93- AND
    174.22-EV LEVELS WERE REPLACED BY THE NEW DATA MEASURED BY
    THEM.  RESONANCE PARAMETERS OF THE TWO NEGATIVE LEVELS WERE
    ALSO MODIFIED SO AS TO REPRODUCE THE ABOVE-MENTIONED THERMAL
    CAPTURE AND SCATTERING CROSS SECTIONS ACCORDING TO THE
    MODIFICATION OF THE POSITIVE LEVELS.

  UNRESOLVED RESONANCE REGION : 2 KEV - 100 KEV
    UNRESOLVED RESONANCE PARAMETERS WERE ADOPTED FROM JENDL-2.
    THE PARAMETERS WERE DETERMINED TO REPRODUCE THE CAPTURE CROSS
    SECTION CALCULATED WITH CASTHY /9/.  THE EFFECTIVE SCATTERING
    RADIUS WAS OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS
    SECTION AT 100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.760E-4, S1 = 1.580E-4, S2 = 0.990E-4, SG = 88.5E-4,
    GG = 0.1175EV, R  = 5.605 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           9.740                     -
      ELASTIC         3.540                     -
      CAPTURE         6.200                    148

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/10/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING R0 AND RSO OF IIJIMA-KAWAI POTENTIAL/11/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/12/
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    ALPHA    = HUIZENGA AND IGO/13/
    DEUTERON = LOHR AND HAEBERLI/14/
    HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/15/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/16/ WERE EVALUATED BY IIJIMA ET AL./17/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /18/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./19/

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.        0.0            5/2 +
            1         0.0576         7/2 +
            2         0.2028         3/2 +
            3         0.3750         1/2 +
            4         0.4179         5/2 +
            5         0.6184         3/2 +
            6         0.6286         7/2 +
            7         0.6510         9/2 +
            8         0.7165        11/2 +
            9         0.7446         9/2 +
           10         0.9910         3/2 +
      LEVELS ABOVE 1.1 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/20/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (8.29E-03) WAS ADJUSTED TO
    REPRODUCE THE CAPTURE CROSS SECTION OF 760 MILLI-BARNS AT 25
    KEV MEASURED BY YAMAMURO ET AL./21/

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT = 32  (N,N'D) CROSS SECTION
  MT = 33  (N,N'T) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =106  (N,HE3) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (= 185.0) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/22/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,2N), (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,2N)      1800.00  MB (RECOMMENDED BY BYCHKOV+/23/)
      (N,P)         16.00  MB (RECOMMENDED BY FORREST/24/)
      (N,ALPHA)      1.50  MB (RECOMMENDED BY FORREST)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
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OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

	DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
	V = 45.97-0.199E	R0 = 6.481	A0 = 0.62
	WS = 6.502	RS = 6.926	AS = 0.35
	VSO= 7.0	RSO= 6.49	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
51-SB-123		1.585E+01	6.213E-01	1.285E+00	5.469E+00	1.430E+00
51-SB-124		1.696E+01	5.600E-01	1.090E+01	3.433E+00	0.0
51-SB-125		1.700E+01	5.120E-01	7.883E-01	3.792E+00	1.090E+00
51-SB-126		1.700E+01	5.250E-01	7.566E+00	2.897E+00	0.0
52-TE-124		1.784E+01	6.740E-01	1.452E+00	8.479E+00	2.570E+00
52-TE-125		1.992E+01	5.590E-01	5.035E+00	5.527E+00	1.140E+00
52-TE-126		1.706E+01	6.100E-01	5.154E-01	6.554E+00	2.230E+00
52-TE-127		2.004E+01	5.380E-01	3.633E+00	5.165E+00	1.140E+00
53-I -125	*	1.789E+01	5.895E-01	2.042E+00	5.696E+00	1.430E+00
53-I -126	*	1.763E+01	5.871E-01	1.981E+01	4.127E+00	0.0
53-I -127		1.717E+01	6.263E-01	4.458E+00	5.757E+00	1.090E+00
53-I -128		1.715E+01	6.200E-01	2.329E+01	4.542E+00	0.0

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 7.0 FOR I -127 AND 5.0 FOR I -128.

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MAT number = 5331
 53-I -129 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 3.391 KEV
    RESONANCE PARAMETERS OF JENDL-2 WERE MODIFIED AS FOLLOWS :
    EVALUATION FOR JENDL-2 WAS CARRIED OUT ON THE BASIS OF THE
    DATA MEASURED BY MACKLIN/3/.  RESONANCE ENERGIES FOR 125
    LEVELS WERE BASED ON THE MEASUREMENT BY MACKLIN EXCEPT THE 1ST
    LEVEL.  NEUTRON ORBITAL ANGULAR MOMENTUM L WAS ASSUMED TO BE 0
    FOR ALL RESONANCE LEVELS.  RADIATION WIDTH FOR EACH RESONANCE
    LEVEL WAS NOT GIVEN BY MACKLIN.  THEREFORE, AVERAGE RADIATION
    WIDTH OF 120 MEV WAS ASSUMED BY TAKING ACCOUNT OF THE MAXIMUM
    VALUE (58.5 MEV) OF NEUTRON CAPTURE AREAS MEASURED BY MACKLIN.
    NEUTRON WIDTHS WERE DERIVED FROM THE NEUTRON CAPTURE AREAS AND
    THE AVERAGE RADIATION WIDTH.  SINCE THE VALUES OF TOTAL SPIN
    FOR ALL RESONANCE LEVELS WERE UNKNOWN, THE TARGET SPIN OF 3.5
    WAS ADOPTED AS THEIR TOTAL SPIN.  A NEGATIVE RESONANCE WAS
    ADDED AT -10 EV SO AS TO REPRODUCE THE THERMAL CAPTURE CROSS
    SECTION OF 27 BARNS GIVEN BY MUGHABGHAB ET AL./4/ SCATTERING
    RADIUS WAS TAKEN FROM THE GRAPH (FIG. 1, PART A) GIVEN IN
    REF./4/.

    FOR JENDL-3, THE TOTAL SPIN OF 126 RESONANCE LEVELS WAS
    TENTATIVELY ESTIMATED WITH A RANDOM NUMBER METHOD.  NEUTRON
    WIDTHS OF THESE LEVELS WERE MODIFIED ON THE BASIS OF THE
    ESTIMATED J-VALUES.  NEUTRON AND RADIATION WIDTHS OF THE
    NEGATIVE RESONANCE LEVEL WERE ALSO MODIFIED SO AS TO REPRODUCE
    THE THERMAL CAPTURE CROSS SECTION ACCORDING TO THE ABOVE
    MODIFICATION OF THE NEUTRON WIDTHS.

  UNRESOLVED RESONANCE REGION : 3.391 KEV - 100 KEV
    UNRESOLVED RESONANCE PARAMETERS WERE ADOPTED FROM JENDL-2.
    THE PARAMETERS WERE ADJUSTED TO REPRODUCE THE CAPTURE CROSS
    SECTION MEASURED BY MACKLIN /3/.  THE EFFECTIVE SCATTERING
    RADIUS WAS OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS
    SECTION AT 100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.532E-4, S1 = 1.332E-4, S2 = 0.887E-4, SG = 51.8E-4,
    GG = 0.160 EV, R  = 5.390 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S                 RES. INTEG.
      TOTAL          33.47                       -
      ELASTIC         6.471                      -
      CAPTURE        27.00                      29.4

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY/5/, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/6/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION, CHANGED FROM R0 AND RSO OF IIJIMA AND KAWAI/7/.  THE
  OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/8/
     ALPHA    = HUIZENGA AND IGO/9/
     DEUTERON = LOHR AND HAEBERLI/10/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/11/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/12/ WERE EVALUATED BY IIJIMA ET AL./13/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /14/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
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CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

MT = 4, 51 - 91 INELASTIC SCATTERING
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS ADOPTED. THE LEVEL SCHEME WAS TAKEN FROM REF./15/

NO.	ENERGY(MEV)	SPIN-PARITY
GR.	0.0	7/2 +
1	0.0278	5/2 +
2	0.2784	3/2 +
3	0.4874	5/2 +
4	0.5596	1/2 +
5	0.6960	11/2 +
6	0.7296	9/2 +
7	0.7689	7/2 +
8	0.8299	3/2 +
9	0.8450	7/2 +
10	1.0470	3/2 +
11	1.0504	7/2 +
12	1.1117	5/2 +
13	1.2100	1/2 +
14	1.2608	5/2 +
15	1.2821	3/2 +
16	1.2922	1/2 +
17	1.4016	9/2 +
18	1.4835	1/2 +

LEVELS ABOVE 1.55 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/16/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (5.13E-03) WAS ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION OF 215 MILLI-BARNS AT 100 KEV MEASURED BY MACKLIN./3/

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT = 32 (N,N'D) CROSS SECTION
MT = 33 (N,N'T) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 221.7) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/17/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,2N), (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,2N)	1500.00 MB	(SYSTEMATICS OF WEN DEN LU+/18/)
(N,P)	3.64 MB	(SYSTEMATICS OF FORREST/19/)
(N,ALPHA)	1.86 MB	(SYSTEMATICS OF FORREST)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING FROM OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 45.97-0.199E	R0 = 6.481	A0 = 0.62
WS = 6.502	RS = 6.926	AS = 0.35

VSO= 7.0 RSO= 6.49 ASO= 0.62
THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
51-SB-125	1.700E+01	5.120E-01	7.883E-01	3.792E+00	1.090E+00
51-SB-126	1.700E+01	5.250E-01	7.566E+00	2.897E+00	0.0
51-SB-127	1.700E+01	5.120E-01	6.326E-01	3.902E+00	1.200E+00
51-SB-128	1.468E+01	5.600E-01	4.264E+00	2.658E+00	0.0
52-TE-126	1.706E+01	6.100E-01	5.154E-01	6.554E+00	2.230E+00
52-TE-127	2.004E+01	5.380E-01	3.633E+00	5.165E+00	1.140E+00
52-TE-128	1.800E+01	6.090E-01	6.586E-01	7.010E+00	2.340E+00
52-TE-129	2.015E+01	5.350E-01	3.588E+00	5.141E+00	1.140E+00
53-I -127	1.717E+01	6.263E-01	4.458E+00	5.757E+00	1.090E+00
53-I -128	1.715E+01	6.200E-01	2.329E+01	4.542E+00	0.0
53-I -129	1.720E+01	6.200E-01	3.436E+00	5.762E+00	1.200E+00
53-I -130	1.640E+01	6.000E-01	1.297E+01	3.896E+00	0.0

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 5.277 FOR I -129 AND 5.0 FOR I -130.

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MAT number = 5337

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 53-I -131 JNDC        EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                       DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  NO RESOLVED RESONANCE PARAMETERS

  UNRESOLVED RESONANCE REGION : 38 EV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/2/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.  THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS
    OF MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.980E-4, S1 = 1.600E-4, S2 = 0.980E-4, SG = 20.1E-4,
    GG = 0.120 EV, R  = 5.399 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S                RES. INTEG.
      TOTAL          83.60                      -
      ELASTIC         3.600                     -
      CAPTURE        80.00                     77.8

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 38 EV, THE CAPTURE AND ELASTIC SCATTERING CROSS SECTIONS
  WERE ASSUMED TO BE IN 1/V FORM AND CONSTANT, RESPECTIVELY.
  THE CAPTURE CROSS SECTION AT 0.0253 EV WAS TAKEN FROM REF./3/,
  AND THE SCATTERING CROSS SECTION WAS ESTIMATED FROM R = 5.4 FM.
  UNRESOLVED RESONANCE PARAMETERS WERE GIVEN IN THE ENERGY RANGE
  FROM 38 EV TO 100 KEV.

  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/4/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING RO AND RSO OF IIJIMA-KAWAI POTENTIAL/5/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/6/
     ALPHA    = HUIZENGA AND IGO/7/
     DEUTERON = LOHR AND HAEBERLI/8/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/9/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/10/ WERE EVALUATED BY IIJIMA ET AL./11/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /12/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/13/ AND NUCLEAR DATA
    SHEETS/14/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0            7/2 +
            1        0.1497         5/2 +
            2        0.4927         3/2 +
            3        0.6020         5/2 +
            4        0.7737        11/2 +
            5        0.8522         9/2 +
            6        0.8767         1/2 +
            7        1.0058         7/2 +
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            8         1.0597          9/2 +
            9         1.0983          3/2 +
           10         1.1469          5/2 +
           11         1.1489          7/2 +
           12         1.2840          5/2 +
           13         1.2982          3/2 +
           14         1.3152          9/2 +
           15         1.3465          1/2 +
      LEVELS ABOVE 1.377 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/15/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (1.97E-03) WAS DETERMINED FROM
    THE SYSTEMATICS OF RADIATION WIDTH (0.12 EV) AND THE AVERAGE
    S-WAVE RESONANCE LEVEL SPACING (60.7 EV) CALCULATED FROM THE
    LEVEL DENSITY PARAMETERS.

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT = 32  (N,N'D) CROSS SECTION
  MT = 33  (N,N'T) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (= 274.9) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/16/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,2N), (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,2N)       1710.00  MB (SYSTEMATICS OF WEN DEN LU+/17/)
      (N,P)           1.99  MB (SYSTEMATICS OF FORREST/18/)
      (N,ALPHA)       1.10  MB (SYSTEMATICS OF FORREST)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.
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TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 45.97-0.199E	R0 = 6.481	A0 = 0.62
WS = 6.502	RS = 6.926	AS = 0.35
VSO= 7.0	RSO= 6.49	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
51-SB-127	1.700E+01	5.120E-01	6.326E-01	3.902E+00	1.200E+00
51-SB-128	1.468E+01	5.600E-01	4.264E+00	2.658E+00	0.0
51-SB-129	1.596E+01	5.040E-01	5.308E-01	3.333E+00	1.040E+00
51-SB-130	1.566E+01	5.000E-01	3.630E+00	2.154E+00	0.0
52-TE-128	1.800E+01	6.090E-01	6.586E-01	7.010E+00	2.340E+00
52-TE-129	2.015E+01	5.350E-01	3.588E+00	5.141E+00	1.140E+00
52-TE-130	1.800E+01	5.470E-01	2.657E-01	5.735E+00	2.180E+00
52-TE-131	1.846E+01	5.360E-01	1.800E+00	4.651E+00	1.140E+00

53-I -129	1.720E+01	6.200E-01	3.436E+00	5.762E+00	1.200E+00
53-I -130	1.640E+01	6.000E-01	1.297E+01	3.896E+00	0.0
53-I -131	1.600E+01	6.330E-01	2.958E+00	5.342E+00	1.040E+00
53-I -132	1.550E+01	6.000E-01	8.595E+00	3.552E+00	0.0

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 6.433 FOR I -131 AND 5.0 FOR I -132.

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MAT number = 5425

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 54-XE-124 JNDC        EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                       DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 0.29 KEV
    RESONANCE PARAMETERS FOR THE THREE POSITIVE LEVELS AT 5.16,
    9.88, AND 252 EV WERE BASED ON THE DATA GIVEN BY MUGHABGHAB ET
    AL./2/  RADIATION WIDTH OF 90.4 MEV WAS DERIVED FROM THE TOTAL
    AND NEUTRON WIDTHS OF THE 2ND LEVEL, AND 90 MEV WAS ADOPTED AS
    THE AVERAGE RADIATION WIDTH FOR THE OTHER LEVELS.  NEUTRON
    ORBITAL ANGULAR MOMENTUM L WAS ASSUMED TO BE 0 FOR ALL
    RESONANCE LEVELS.  SCATTERING RADIUS WAS ALSO TAKEN FROM THE
    GRAPH (FIG. 1, PART A) GIVEN BY MUGHABGHAB ET AL.  A NEGATIVE
    RESONANCE WAS ADDED AT -118 EV, AND THE NEUTRON WIDTH WAS
    DETERMINED SO AS TO REPRODUCE THE THERMAL CAPTURE CROSS
    SECTION OF 165+-20 BARNS/2/.

  UNRESOLVED RESONANCE REGION : 0.29 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/3/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.  THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS
    OF MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.970E-4, S1 = 1.700E-4, S2 = 1.100E-4, SG = 82.1E-4,
    GG = 0.140 EV, R  = 5.374 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL         266.0                     -
      ELASTIC       101.0                     -
      CAPTURE       165.0                   2970

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/4/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING R0 AND RSO OF IIJIMA-KAWAI POTENTIAL/5/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/6/
     ALPHA    = HUIZENGA AND IGO/7/
     DEUTERON = LOHR AND HAEBERLI/8/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/9/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/10/ WERE EVALUATED BY IIJIMA ET AL./11/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /12/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/13/ AND NUCLEAR DATA
    SHEETS/14/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             0  +
            1        0.3540          2  +
            2        0.8469          2  +
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                3         0.8792          4   +
                4         1.2481          3   +
                5         1.2687          0   +
                6         1.4383          4   +
                7         1.5487          6   +
                8         1.6224          0   +
                9         1.6284          2   +
               10         1.6500          0   +
               11         1.6899          0   +
               12         1.7113          4   +
               13         1.8374          5   +
               14         1.9785          4   +
               15         2.1445          6   +
               16         2.2051          4   +
               17         2.3100          0   +
               18         2.3314          8   +
          LEVELS ABOVE 2.375 MEV WERE ASSUMED TO BE OVERLAPPING.

      MT = 102  CAPTURE
        SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
        CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
        SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
        AND REFFO/15/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

        THE GAMMA-RAY STRENGTH FUNCTION (8.43E-03) WAS DETERMINED FROM
        THE SYSTEMATICS OF RADIATION WIDTH (0.14 EV) AND THE AVERAGE
        S-WAVE RESONANCE LEVEL SPACING (16.6 EV) CALCULATED FROM THE
        LEVEL DENSITY PARAMETERS.

      MT = 16  (N,2N) CROSS SECTION
      MT = 17  (N,3N) CROSS SECTION
      MT = 22  (N,N'A) CROSS SECTION
      MT = 28  (N,N'P) CROSS SECTION
      MT = 32  (N,N'D) CROSS SECTION
      MT =103  (N,P) CROSS SECTION
      MT =104  (N,D) CROSS SECTION
      MT =105  (N,T) CROSS SECTION
      MT =106  (N,HE3) CROSS SECTION
      MT =107  (N,ALPHA) CROSS SECTION
      MT =111  (N,2P) CROSS SECTION
        THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
        PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

        THE KALBACH'S CONSTANT K (= 100.9) WAS ESTIMATED BY THE
        FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/16/ AND LEVEL
        DENSITY PARAMETERS.

        FINALLY, THE (N,2N), (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
        NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
          (N,2N)      1000.00  MB (RECOMMENDED BY BYCHKOV+/17/)
          (N,P)         34.30  MB (SYSTEMATICS OF FORREST/18/)
          (N,ALPHA)     14.90  MB (SYSTEMATICS OF FORREST)

      MT = 251  MU-BAR
        CALCULATED WITH CASTHY.

    MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
      LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
      GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
      TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
      CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
      BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

    MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
      ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
      PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
      OTHER NEUTRON EMITTING REACTIONS.

    TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                    DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
             ----------------------  ------------  ---------------
            V  = 45.97-0.199E        R0 = 6.481    A0 = 0.62
            WS = 6.502               RS = 6.926    AS = 0.35
            VSO= 7.0                 RSO= 6.49     ASO= 0.62
      THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

    TABLE 2  LEVEL DENSITY PARAMETERS

     NUCLIDE   SYST A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
     ---------------------------------------------------------------
     52-TE-120      1.700E+01 5.940E-01 3.471E-01 6.309E+00 2.290E+00
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52-TE-121		1.800E+01	6.200E-01	5.720E+00	6.022E+00	1.140E+00
52-TE-122		1.705E+01	6.350E-01	6.339E-01	7.160E+00	2.380E+00
52-TE-123		1.874E+01	5.850E-01	4.619E+00	5.627E+00	1.140E+00
53-I -121	*	1.889E+01	5.992E-01	6.188E+00	5.966E+00	1.150E+00
53-I -122	*	1.865E+01	5.968E-01	3.635E+01	4.680E+00	0.0
53-I -123	*	1.840E+01	5.943E-01	3.884E+00	5.783E+00	1.240E+00
53-I -124		1.950E+01	5.240E-01	2.017E+01	3.611E+00	0.0
54-XE-122	*	1.904E+01	5.968E-01	9.775E-01	7.096E+00	2.270E+00
54-XE-123		1.908E+01	5.770E-01	4.895E+00	5.573E+00	1.120E+00
54-XE-124		1.992E+01	5.860E-01	1.014E+00	7.286E+00	2.360E+00
54-XE-125		2.050E+01	5.530E-01	6.059E+00	5.576E+00	1.120E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 8.902 FOR XE-124 AND 5.0 FOR XE-125.

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MAT number = 5431

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 54-XE-126 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 0.485 KEV
    RESONANCE PARAMETERS WERE EVALUATED FOR A LEVEL AT 460 EV
    BASED ON THE DATA GIVEN BY MUGHABGHAB ET AL./2/  NEUTRON AND
    RADIATION WIDTHS WERE MODIFIED SO AS TO REPRODUCE THE NEUTRON
    RESONANCE CAPTURE INTEGRAL OF 60+-10 BARNS/2/.  NEUTRON
    ORBITAL ANGULAR MOMENTUM L OF THIS LEVEL WAS ASSUMED TO BE 0.
    SCATTERING RADIUS WAS ALSO TAKEN FROM THE GRAPH(FIG.1, PART A)
    GIVEN BY MUGHABGHAB ET AL.  A NEGATIVE RESONANCE WAS ADDED AT
    -100 EV, AND THE NEUTRON AND RADIATION WIDTHS WERE DETERMINED
    SO AS TO REPRODUCE THE THERMAL CAPTURE CROSS SECTION OF 3.5+-
    0.8 BARNS /2/.

  UNRESOLVED RESONANCE REGION : 0.485 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/3/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.  THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS
    OF MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.980E-4, S1 = 1.700E-4, S2 = 1.000E-4, SG = 30.2E-4,
    GG = 0.150 EV, R  = 5.358 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                   2200 M/S               RES. INTEG.
      TOTAL        11.72                    -
      ELASTIC       7.453                   -
      CAPTURE       4.269                  23.4

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/4/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING R0 AND RSO OF IIJIMA-KAWAI POTENTIAL/5/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/6/
     ALPHA    = HUIZENGA AND IGO/7/
     DEUTERON = LOHR AND HAEBERLI/8/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/9/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/10/ WERE EVALUATED BY IIJIMA ET AL./11/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /12/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/13/ AND NUCLEAR DATA
    SHEETS/14/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             0  +
            1        0.3886          2  +
            2        0.8799          2  +
            3        0.9419          4  +
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          4         1.3138          0  +
          5         1.3174          3  +
          6         1.4884          4  +
          7         1.6349          6  +
          8         1.6784          2  +
          9         1.7600          0  +
         10         1.9032          5  +
         11         2.0631          4  +
         12         2.2144          6  +
         13         2.3472          1  +
         14         2.4356          8  +
         15         2.4559          1  +
     LEVELS ABOVE 2.488 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/15/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (2.99E-03) WAS DETERMINED FROM
    THE SYSTEMATICS OF RADIATION WIDTH (0.15 EV) AND THE AVERAGE
    S-WAVE RESONANCE LEVEL SPACING (50.1 EV) CALCULATED FROM THE
    LEVEL DENSITY PARAMETERS.

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =106  (N,HE3) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (= 117.1) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/16/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,2N), (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,2N)      1400.00  MB (RECOMMENDED BY BYCHKOV+/17/)
      (N,P)         19.00  MB (SYSTEMATICS OF FORREST/18/)
      (N,ALPHA)      8.33  MB (SYSTEMATICS OF FORREST)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
         ----------------------  ------------  ---------------
        V  = 45.97-0.199E        R0 = 6.481    A0 = 0.62
        WS = 6.502               RS = 6.926    AS = 0.35
        VSO= 7.0                 RSO= 6.49     ASO= 0.62
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2  LEVEL DENSITY PARAMETERS

 NUCLIDE   SYST A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
 ---------------------------------------------------------------
 52-TE-122      1.705E+01 6.350E-01 6.339E-01 7.160E+00 2.380E+00
 52-TE-123      1.874E+01 5.850E-01 4.619E+00 5.627E+00 1.140E+00
 52-TE-124      1.784E+01 6.740E-01 1.452E+00 8.479E+00 2.570E+00
 52-TE-125      1.992E+01 5.590E-01 5.035E+00 5.527E+00 1.140E+00

 53-I -123   *  1.840E+01 5.943E-01 3.884E+00 5.783E+00 1.240E+00
 53-I -124      1.950E+01 5.240E-01 2.017E+01 3.611E+00 0.0
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53-I -125	*	1.789E+01	5.895E-01	2.042E+00	5.696E+00	1.430E+00
53-I -126	*	1.763E+01	5.871E-01	1.981E+01	4.127E+00	0.0
54-XE-124		1.992E+01	5.860E-01	1.014E+00	7.286E+00	2.360E+00
54-XE-125		2.050E+01	5.530E-01	6.059E+00	5.576E+00	1.120E+00
54-XE-126		1.908E+01	6.110E-01	8.260E-01	7.676E+00	2.550E+00
54-XE-127		1.982E+01	5.420E-01	3.686E+00	5.152E+00	1.120E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 9.458 FOR XE-126 AND 5.0 FOR XE-127.

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MAT number = 5437

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 54-XE-128 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 1.7 KEV
    RESONANCE PARAMETERS WERE BASED ON THE DATA GIVEN BY
    MUGHABGHAB ET AL./2/, EXCEPT NEUTRON WIDTH OF THE 3RD LEVEL
    WHICH WAS DERIVED FROM THE VALUE OF G*(REDUCED NEUTRON WIDTH)
    ESTIMATED ON THE BASIS OF THE SYSTEMATICS OF THOSE FOR
    NEIGHBORING LEVELS.  RADIATION WIDTH OF 66 MEV FOR THE 1ST
    LEVEL WAS OBTAINED FROM THE TOTAL AND NEUTRON WIDTHS.  AVERAGE
    RADIATION WIDTH OF 70 MEV CLOSE TO THAT OF THE 1ST LEVEL WAS
    ADOPTED FOR THE OTHER LEVELS.  NEUTRON ORBITAL ANGULAR
    MOMENTUM L WAS ASSUMED TO BE 0 FOR ALL RESONANCE LEVELS.  A
    NEGATIVE RESONANCE WAS ADDED AT -100 EV SO AS TO REPRODUCE THE
    THERMAL CAPTURE CROSS SECTION GIVEN BY MUGHABGHAB ET AL.
    SCATTERING RADIUS WAS TAKEN FROM THE GRAPH (FIG. 1, PART A)
    GIVEN IN REF./2/.

  UNRESOLVED RESONANCE REGION : 1.7 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/3/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.  THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS
    OF MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.980E-4, S1 = 1.700E-4, S2 = 1.000E-4, SG = 7.60E-4,
    GG = 0.140 EV, R  = 5.348 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL          19.05                      -
      ELASTIC        11.05                      -
      CAPTURE         8.000                    12.5

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/4/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING R0 AND RSO OF IIJIMA-KAWAI POTENTIAL/5/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/6/
     ALPHA    = HUIZENGA AND IGO/7/
     DEUTERON = LOHR AND HAEBERLI/8/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/9/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/10/ WERE EVALUATED BY IIJIMA ET AL./11/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /12/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/13/ AND NUCLEAR DATA
    SHEETS/14/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             0  +
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1	0.4429	2	+
2	0.9695	2	+
3	1.0331	4	+
4	1.4296	3	+
5	1.5830	0	+
6	1.6034	4	+
7	1.7370	6	+
8	1.8773	0	+
9	1.9965	5	+
10	1.9996	2	+
11	2.1271	1	+
12	2.2290	5	-
13	2.2529	1	-
14	2.2728	2	+
15	2.2809	5	+
16	2.3618	1	+
17	2.4211	3	-
18	2.4307	1	+
19	2.4439	0	+
20	2.4825	1	+
21	2.5008	4	-
22	2.5107	2	+
23	2.5125	8	+

LEVELS ABOVE 2.521 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/15/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (7.25E-04) WAS DETERMINED FROM THE SYSTEMATICS OF RADIATION WIDTH (0.14 EV) AND THE AVERAGE S-WAVE RESONANCE LEVEL SPACING (193 EV) CALCULATED FROM THE LEVEL DENSITY PARAMETERS.

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 131.7) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/16/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,2N), (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,2N)	1446.00	MB	(RECOMMENDED BY BYCHKOV+/17/)
(N,P)	27.00	MB	(RECOMMENDED BY FORREST/18/)
(N,ALPHA)	4.74	MB	(SYSTEMATICS OF FORREST/18/)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 45.97-0.199E	R0 = 6.481	A0 = 0.62
WS = 6.502	RS = 6.926	AS = 0.35
VSO= 7.0	RSO= 6.49	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
52-TE-124		1.784E+01	6.740E-01	1.452E+00	8.479E+00	2.570E+00
52-TE-125		1.992E+01	5.590E-01	5.035E+00	5.527E+00	1.140E+00
52-TE-126		1.706E+01	6.100E-01	5.154E-01	6.554E+00	2.230E+00
52-TE-127		2.004E+01	5.380E-01	3.633E+00	5.165E+00	1.140E+00
53-I -125	*	1.789E+01	5.895E-01	2.042E+00	5.696E+00	1.430E+00
53-I -126	*	1.763E+01	5.871E-01	1.981E+01	4.127E+00	0.0
53-I -127		1.717E+01	6.263E-01	4.458E+00	5.757E+00	1.090E+00
53-I -128		1.715E+01	6.200E-01	2.329E+01	4.542E+00	0.0
54-XE-126		1.908E+01	6.110E-01	8.260E-01	7.676E+00	2.550E+00
54-XE-127		1.982E+01	5.420E-01	3.686E+00	5.152E+00	1.120E+00
54-XE-128		1.800E+01	5.830E-01	5.017E-01	6.396E+00	2.210E+00
54-XE-129		1.936E+01	5.729E-01	5.108E+00	5.590E+00	1.120E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 7.255 FOR XE-128 AND 8.187 FOR XE-129.

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MAT number = 5440
 54-XE-129 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 2.7 KEV
    RESONANCE PARAMETERS OF THE 69 LEVELS FROM 9.5 TO 4082 EV
    WERE BASED ON THE DATA GIVEN BY MUGHABGHAB ET AL./2/  NEUTRON
    ORBITAL ANGULAR MOMENTUM L WAS ASSUMED TO BE 0 FOR ALL
    RESONANCE LEVELS.  TOTAL SPIN J OF SOME RESONANCES WAS
    TENTATIVELY ESTIMATED WITH A RANDOM NUMBER METHOD.  NEUTRON
    WIDTHS WERE DETERMINED FROM THE DATA OF 2G*(NEUTRON WIDTH).
    RADIATION WIDTHS FOR THE 56 LEVELS WERE OBTAINED FROM THE
    TOTAL AND NEUTRON WIDTHS.  AVERAGE RADIATION WIDTH OF 200 MEV
    WAS OBTAINED BY TAKING THE WEIGHTED AVERAGE OF GIVEN DATA,
    AND WAS ADOPTED FOR THE 13 LEVELS WHOSE RADIATION WIDTH WAS
    UNKNOWN.  SCATTERING RADIUS WAS TAKEN FROM THE GRAPH (FIG. 1,
    PART A) GIVEN BY MUGHABGHAB ET AL.  A NEGATIVE RESONANCE WAS
    ADDED AT -50 EV SO AS TO REPRODUCE THE THERMAL CAPTURE CROSS
    SECTION OF 21+-5 BARNS/2/.

  UNRESOLVED RESONANCE REGION : 2.7 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/3/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.  THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS
    OF MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.980E-4, S1 = 1.600E-4, S2 = 1.000E-4, SG = 31.5E-4,
    GG = 0.140 EV, R  = 5.407 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL          42.04                     -
      ELASTIC        21.04                     -
      CAPTURE        21.00                    256

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/4/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING R0 AND RSO OF IIJIMA-KAWAI POTENTIAL/5/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/6/
     ALPHA    = HUIZENGA AND IGO/7/
     DEUTERON = LOHR AND HAEBERLI/8/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/9/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/10/ WERE EVALUATED BY IIJIMA ET AL./11/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /12/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/13/ AND NUCLEAR DATA
    SHEETS/14/.

           NO.      ENERGY(MEV)    SPIN-PARITY
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             GR.         0.0            1/2 +
              1          0.0396         3/2 +
              2          0.2361        11/2 -
              3          0.3182         3/2 +
              4          0.3217         5/2 +
              5          0.4115         1/2 +
              6          0.5187         7/2 +
              7          0.5727         5/2 +
              8          0.5885         3/2 +
              9          0.6245         3/2 +
             10          0.6654         7/2 +
             11          0.7711        13/2 -
             12          0.8222         9/2 +
             13          0.8232        15/2 -
             14          0.8680         7/2 +
             15          0.9043         3/2 +
             16          0.9460         1/2 +
        LEVELS ABOVE 0.986 MEV WERE ASSUMED TO BE OVERLAPPING.

    MT = 102  CAPTURE
      SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
      CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
      SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
      AND REFFO/15/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

      THE GAMMA-RAY STRENGTH FUNCTION (3.12E-03) WAS DETERMINED FROM
      THE SYSTEMATICS OF RADIATION WIDTH (0.14 EV) AND AVERAGE
      S-WAVE RESONANCE LEVEL SPACING (45+-8 EV/2/).

    MT = 16  (N,2N) CROSS SECTION
    MT = 17  (N,3N) CROSS SECTION
    MT = 22  (N,N'A) CROSS SECTION
    MT = 28  (N,N'P) CROSS SECTION
    MT = 32  (N,N'D) CROSS SECTION
    MT =103  (N,P) CROSS SECTION
    MT =104  (N,D) CROSS SECTION
    MT =105  (N,T) CROSS SECTION
    MT =106  (N,HE3) CROSS SECTION
    MT =107  (N,ALPHA) CROSS SECTION
      THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
      PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

      THE KALBACH'S CONSTANT K (= 209.6) WAS ESTIMATED BY THE
      FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/16/ AND LEVEL
      DENSITY PARAMETERS.

      FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
      NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
        (N,P)           7.79  MB (SYSTEMATICS OF FORREST/17/)
        (N,ALPHA)       3.60  MB (SYSTEMATICS OF FORREST)

    MT = 251  MU-BAR
      CALCULATED WITH CASTHY.

  MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
    LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
    GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
    TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
    CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
    BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

  MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
    ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
    PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
    OTHER NEUTRON EMITTING REACTIONS.

  TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                  DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
           ----------------------  ------------  ---------------
          V  = 45.97-0.199E        R0 = 6.481    A0 = 0.62
          WS = 6.502               RS = 6.926    AS = 0.35
          VSO= 7.0                 RSO= 6.49     ASO= 0.62
    THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

  TABLE 2  LEVEL DENSITY PARAMETERS

   NUCLIDE   SYST A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
   ---------------------------------------------------------------
   52-TE-125      1.992E+01 5.590E-01 5.035E+00 5.527E+00 1.140E+00
   52-TE-126      1.706E+01 6.100E-01 5.154E-01 6.554E+00 2.230E+00
   52-TE-127      2.004E+01 5.380E-01 3.633E+00 5.165E+00 1.140E+00
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52-TE-128		1.800E+01	6.090E-01	6.586E-01	7.010E+00	2.340E+00
53-I -126	*	1.763E+01	5.871E-01	1.981E+01	4.127E+00	0.0
53-I -127		1.717E+01	6.263E-01	4.458E+00	5.757E+00	1.090E+00
53-I -128		1.715E+01	6.200E-01	2.329E+01	4.542E+00	0.0
53-I -129		1.720E+01	6.200E-01	3.436E+00	5.762E+00	1.200E+00
54-XE-127		1.982E+01	5.420E-01	3.686E+00	5.152E+00	1.120E+00
54-XE-128		1.800E+01	5.830E-01	5.017E-01	6.396E+00	2.210E+00
54-XE-129		1.936E+01	5.729E-01	5.108E+00	5.590E+00	1.120E+00
54-XE-130		1.671E+01	6.600E-01	8.841E-01	7.427E+00	2.320E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 8.187 FOR XE-129 AND 5.625 FOR XE-130.

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MAT number = 5443

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 54-XE-130 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 3.6 KEV
    RESONANCE PARAMETERS OF THE 16 LEVELS FROM 430 TO 3564 EV
    WERE BASED ON THE DATA GIVEN BY MUGHABGHAB ET AL./2/  NEUTRON
    ORBITAL ANGULAR MOMENTUM L WAS ASSUMED TO BE 0 FOR ALL
    RESONANCE LEVELS.  RADIATION WIDTHS FOR THE 6 LEVELS WERE
    OBTAINED FROM THE TOTAL AND NEUTRON WIDTHS.  AVERAGE
    RADIATION WIDTH OF 220 MEV WAS OBTAINED BY AVERAGING THE
    ABOVE 6 RADIATION WIDTHS, AND WAS ADOPTED FOR THE 10 LEVELS
    WHOSE RADIATION WIDTH WAS UNKNOWN.  SCATTERING RADIUS WAS
    TAKEN FROM THE GRAPH (FIG. 1, PART A) GIVEN BY MUGHABGHAB ET
    AL.  A NEGATIVE RESONANCE WAS ADDED AT -400 EV SO AS TO
    REPRODUCE THE THERMAL CAPTURE CROSS SECTION/2/.

  UNRESOLVED RESONANCE REGION : 3.6 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/3/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.  THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS
    OF MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.980E-4, S1 = 1.600E-4, S2 = 0.990E-4, SG = 7.23E-4,
    GG = 0.130 EV, R  = 5.402 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S                RES. INTEG.
      TOTAL          40.48                      -
      ELASTIC        14.48                      -
      CAPTURE        26.00                     17.8

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/4/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING R0 AND RSO OF IIJIMA-KAWAI POTENTIAL/5/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/6/
     ALPHA    = HUIZENGA AND IGO/7/
     DEUTERON = LOHR AND HAEBERLI/8/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/9/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/10/ WERE EVALUATED BY IIJIMA ET AL./11/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /12/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/13/ AND NUCLEAR DATA
    SHEETS/14/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             0  +
            1        0.5361          2  +
            2        1.1222          2  +
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3	1.2046	4 +
4	1.6325	3 +

LEVELS ABOVE 1.786 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/15/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (6.84E-04) WAS DETERMINED FROM THE SYSTEMATICS OF RADIATION WIDTH (0.13 EV) AND AVERAGE S-WAVE RESONANCE LEVEL SPACING (190+-60 EV/2/).

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 189.9) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/16/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,2N), (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,2N)	1590.00 MB	(SYSTEMATICS OF WEN DEN LU+/17/)
(N,P)	10.00 MB	(RECOMMENDED BY FORREST/18/)
(N,ALPHA)	2.74 MB	(SYSTEMATICS OF FORREST/18/)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 45.97-0.199E	R0 = 6.481	A0 = 0.62
WS = 6.502	RS = 6.926	AS = 0.35
VSO= 7.0	RSO= 6.49	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
52-TE-126	1.706E+01	6.100E-01	5.154E-01	6.554E+00	2.230E+00
52-TE-127	2.004E+01	5.380E-01	3.633E+00	5.165E+00	1.140E+00
52-TE-128	1.800E+01	6.090E-01	6.586E-01	7.010E+00	2.340E+00
52-TE-129	2.015E+01	5.350E-01	3.588E+00	5.141E+00	1.140E+00
53-I -127	1.717E+01	6.263E-01	4.458E+00	5.757E+00	1.090E+00
53-I -128	1.715E+01	6.200E-01	2.329E+01	4.542E+00	0.0
53-I -129	1.720E+01	6.200E-01	3.436E+00	5.762E+00	1.200E+00
53-I -130	1.640E+01	6.000E-01	1.297E+01	3.896E+00	0.0
54-XE-128	1.800E+01	5.830E-01	5.017E-01	6.396E+00	2.210E+00
54-XE-129	1.936E+01	5.729E-01	5.108E+00	5.590E+00	1.120E+00
54-XE-130	1.671E+01	6.600E-01	8.841E-01	7.427E+00	2.320E+00
54-XE-131	1.740E+01	6.000E-01	3.176E+00	5.394E+00	1.120E+00

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 5.625 FOR XE-130 AND 11.68 FOR XE-131.

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MAT number = 5446

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 54-XE-131 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 2.25 KEV
    RESONANCE PARAMETERS OF JENDL-2 WAS MODIFIED AS FOLLOWS:
    EVALUATION OF JENDL-2 WAS CARRIED OUT ON THE BASIS OF THE DATA
    MEASURED BY RIBON ET AL./3/  NEUTRON ORBITAL ANGULAR MOMENTUM
    L WAS ASSUMED TO BE 0 FOR ALL THE 40 RESONANCE LEVELS UP TO 4
    KEV.  NEUTRON WIDTHS OF THE 40 LEVELS WERE DETERMINED FROM THE
    2G*(NEUTRON WIDTH) MEASURED BY RIBON ET AL.  HOWEVER, THE
    VALUE OF TOTAL SPIN J FOR EACH RESONANCE LEVEL WAS UNKNOWN
    EXCEPT 24 LEVELS ASSIGNED BY RIBON ET AL., AND THE TARGET SPIN
    OF 1.5 WAS ADOPTED FOR THE J-UNKNOWN LEVELS AS THE TOTAL SPIN.
    RADIATION WIDTHS WERE OBTAINED FROM THE TOTAL AND NEUTRON
    WIDTHS FOR 30 LEVELS.  AVERAGE RADIATION WIDTH OF 111.94 MEV
    WAS DERIVED FROM THE ABOVE RADIATION WIDTHS, AND WAS ADOPTED
    FOR REMAINING 10 LEVELS.  A NEGATIVE RESONANCE WAS ADDED AT
    -84 EV SO AS TO REPRODUCE THE THERMAL CAPTURE CROSS SECTION OF
    85+-10 BARNS GIVEN BY MUGHABGHAB ET AL./4/  SCATTERING RADIUS
    WAS TAKEN FROM THE GRAPH (FIG. 1, PART A) GIVEN BY MUGHABGHAB
    ET AL.

    FOR JENDL-3, THE TOTAL SPIN J OF 16 RESONANCE LEVELS WAS
    TENTATIVELY ESTIMATED WITH A RANDOM NUMBER METHOD.  NEUTRON
    WIDTHS OF THESE LEVELS WERE MODIFIED ON THE BASIS OF THE
    ESTIMATED J-VALUES.

  UNRESOLVED RESONANCE REGION : 2.25 KEV - 100 KEV
    UNRESOLVED RESONANCE PARAMETERS WERE ADOPTED FROM JENDL-2.
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/5/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.700E-4, S1 = 1.580E-4, S2 = 0.990E-4, SG = 30.0E-4,
    GG = 0.114 EV, R  = 5.633 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                       2200 M/S              RES. INTEG.
      TOTAL          109.1                     -
      ELASTIC         24.03                    -
      CAPTURE         85.03                  900

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/6/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING R0 AND RSO OF IIJIMA-KAWAI POTENTIAL/7/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/8/
     ALPHA    = HUIZENGA AND IGO/9/
     DEUTERON = LOHR AND HAEBERLI/10/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/11/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/12/ WERE EVALUATED BY IIJIMA ET AL./13/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /14/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).
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MT = 4, 51 - 91 INELASTIC SCATTERING
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS ADOPTED. THE LEVEL SCHEME WAS TAKEN FROM REF./15/

NO.	ENERGY(MEV)	SPIN-PARITY
GR.	0.0	3/2 +
1	0.0802	1/2 +
2	0.1640	11/2 -
3	0.3418	11/2 -
4	0.3644	5/2 +
5	0.6370	7/2 +
6	0.6671	7/2 -
7	0.7230	5/2 +
8	0.8064	15/2 -

LEVELS ABOVE 0.971 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/16/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (2.92E-03) WAS DETERMINED FROM THE SYSTEMATICS OF RADIATION WIDTH (0.114 EV) AND AVERAGE S-WAVE RESONANCE LEVEL SPACING (39 EV).

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT = 32 (N,N'D) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 268.1) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/17/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
(N,P)   6.00 MB (RECOMMENDED BY FORREST/18/)
(N,ALPHA)   2.10 MB (SYSTEMATICS OF FORREST/18/)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 45.97-0.199E	R0 = 6.481	A0 = 0.62
WS = 6.502	RS = 6.926	AS = 0.35
VSO= 7.0	RSO= 6.49	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
52-TE-127	2.004E+01	5.380E-01	3.633E+00	5.165E+00	1.140E+00
52-TE-128	1.800E+01	6.090E-01	6.586E-01	7.010E+00	2.340E+00
52-TE-129	2.015E+01	5.350E-01	3.588E+00	5.141E+00	1.140E+00
52-TE-130	1.800E+01	5.470E-01	2.657E-01	5.735E+00	2.180E+00
53-I -128	1.715E+01	6.200E-01	2.329E+01	4.542E+00	0.0

53-I -129	1.720E+01	6.200E-01	3.436E+00	5.762E+00	1.200E+00
53-I -130	1.640E+01	6.000E-01	1.297E+01	3.896E+00	0.0
53-I -131	1.600E+01	6.330E-01	2.958E+00	5.342E+00	1.040E+00
54-XE-129	1.936E+01	5.729E-01	5.108E+00	5.590E+00	1.120E+00
54-XE-130	1.671E+01	6.600E-01	8.841E-01	7.427E+00	2.320E+00
54-XE-131	1.740E+01	6.000E-01	3.176E+00	5.394E+00	1.120E+00
54-XE-132	1.563E+01	6.500E-01	5.485E-01	6.600E+00	2.160E+00

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 11.68 FOR XE-131 AND 11.02 FOR XE-132.

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MAT number = 5449

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 54-XE-132 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 4.4 KEV
    EVALUATION OF JENDL-2 WAS CARRIED OUT ON THE BASIS OF THE DATA
    MEASURED BY RIBON ET AL./3/  NEUTRON ORBITAL ANGULAR MOMENTUM
    L WAS ASSUMED TO BE 0 FOR ALL THE 5 LEVELS UP TO 3.9 KEV.
    NEUTRON WIDTHS OF THE 5 LEVELS WERE DETERMINED FROM THE
    G*(NEUTRON WIDTH) MEASURED BY RIBON ET AL.  RADIATION WIDTHS
    WERE OBTAINED FROM THE TOTAL AND NEUTRON WIDTHS.  A NEGATIVE
    RESONANCE WAS ADDED AT -160 EV SO AS TO REPRODUCE THE THERMAL
    CAPTURE CROSS SECTION OF 450+-60 MB GIVEN MUGHABGHAB ET AL./4/
    SCATTERING RADIUS WAS TAKEN FROM THE GRAPH (FIG. 1, PART A)
    GIVEN BY MUGHABGHAB ET AL.

    MODIFICATION OF JENDL-2 WAS NOT DONE IN THE PRESENT WORK FOR
    JENDL-3, BECAUSE THE NEW EXPERIMENTAL DATA HAVE NOT BEEN
    PUBLISHED AFTER JENDL-2.

  UNRESOLVED RESONANCE REGION : 4.4 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/5/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.  THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS
    OF MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.980E-4, S1 = 1.600E-4, S2 = 0.970E-4, SG = 0.646E-4,
    GG = 0.120 EV, R  = 5.393 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           3.600                    -
      ELASTIC         3.150                    -
      CAPTURE         0.4500                    4.51

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/6/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING R0 AND RSO OF IIJIMA-KAWAI POTENTIAL/7/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/8/
     ALPHA    = HUIZENGA AND IGO/9/
     DEUTERON = LOHR AND HAEBERLI/10/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/11/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/12/ WERE EVALUATED BY IIJIMA ET AL./13/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /14/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./15/

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             0  +
            1        0.6677          2  +
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             2         1.2978          2  +
             3         1.4403          4  +
             4         1.8037          3  +
             5         1.9629          4  +
             6         1.9853          2  +
             7         2.0401          5  -
             8         2.1102          4  +
             9         2.1118          6  +
            10         2.2151          7  -
      LEVELS ABOVE 2.351 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/16/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (0.595E-4) WAS ADJUSTED TO
    REPRODUCE THE CAPTURE CROSS SECTION OF 29.3 MILLI-BARNS AT 80
    KEV WHICH WAS A 28 % SMALLER VALUE THAN JENDL-2/17/.

  NOTE : RESULTS OF PREVIOUS INTEGRAL TEST OF JENDL-2/1,17/ WERE
         REFLECTED IN THE PRESENT EVALUATION.

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (= 255.6) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/18/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,P)           3.19  MB (SYSTEMATICS OF FORREST/19/)
      (N,ALPHA)       1.61  MB (SYSTEMATICS OF FORREST)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
         ----------------------   ------------  ---------------
        V  = 45.97-0.199E         R0 = 6.481    A0 = 0.62
        WS = 6.502                RS = 6.926    AS = 0.35
        VSO= 7.0                  RSO= 6.49     ASO= 0.62
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2  LEVEL DENSITY PARAMETERS

 NUCLIDE       A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
 ---------------------------------------------------------------
 52-TE-128     1.800E+01 6.090E-01 6.586E-01 7.010E+00 2.340E+00
 52-TE-129     2.015E+01 5.350E-01 3.588E+00 5.141E+00 1.140E+00
 52-TE-130     1.800E+01 5.470E-01 2.657E-01 5.735E+00 2.180E+00
 52-TE-131     1.846E+01 5.360E-01 1.800E+00 4.651E+00 1.140E+00

 53-I -129     1.720E+01 6.200E-01 3.436E+00 5.762E+00 1.200E+00
 53-I -130     1.640E+01 6.000E-01 1.297E+01 3.896E+00 0.0
 53-I -131     1.600E+01 6.330E-01 2.958E+00 5.342E+00 1.040E+00
 53-I -132     1.550E+01 6.000E-01 8.595E+00 3.552E+00 0.0
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54-XE-130	1.671E+01	6.600E-01	8.841E-01	7.427E+00	2.320E+00
54-XE-131	1.740E+01	6.000E-01	3.176E+00	5.394E+00	1.120E+00
54-XE-132	1.563E+01	6.500E-01	5.485E-01	6.600E+00	2.160E+00
54-XE-133	1.600E+01	6.250E-01	2.327E+00	5.284E+00	1.120E+00

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 11.02 FOR XE-132 AND 6.392 FOR XE-133.

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MAT number = 5452

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 54-XE-133 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  NO RESOLVED RESONANCE PARAMETERS

  UNRESOLVED RESONANCE REGION : 80.5 EV - 100 KEV
    UNRESOLVED RESONANCE PARAMETERS WERE ADOPTED FROM JENDL-2.
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/3/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 1.040E-4, S1 = 1.580E-4, S2 = 0.990E-4, SG = 6.65E-4,
    GG = 0.110 EV, R  = 5.333 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                  2200 M/S               RES. INTEG.
      TOTAL      193.6                     -
      ELASTIC      3.600                   -
      CAPTURE    190.0                    90.1

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 80.5 EV, THE CAPTURE AND ELASTIC SCATTERING CROSS SECTIONS
  WERE ASSUMED TO BE IN 1/V FORM AND CONSTANT, RESPECTIVELY.
  THE CAPTURE CROSS SECTION AT 0.0253 EV WAS TAKEN FROM REF./4/,
  AND THE SCATTERING CROSS SECTION WAS ESTIMATED FROM R = 5.4 FM.
  UNRESOLVED RESONANCE PARAMETERS WERE GIVEN IN THE ENERGY RANGE
  FROM 80.5 EV TO 100 KEV.

  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/5/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING RO AND RSO OF IIJIMA-KAWAI POTENTIAL/6/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/7/
     ALPHA    = HUIZENGA AND IGO/8/
     DEUTERON = LOHR AND HAEBERLI/9/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/10/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/11/ WERE EVALUATED BY IIJIMA ET AL./12/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /13/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./14/

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             3/2 +
            1        0.2332         11/2 -
            2        0.2627          1/2 +
            3        0.5299          5/2 +
            4        0.6802          3/2 +
            5        0.7438          9/2 -
            6        0.8753          7/2 +
            7        0.9115          3/2 +
            8        1.0523          5/2 +
            9        1.2364          7/2 +
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         10        1.2982         5/2 +
         11        1.3503         5/2 +
         12        1.3850         7/2 +
         13        1.4048         7/2 -
         14        1.5901         5/2 -
    LEVELS ABOVE 1.65 MEV WERE ASSUMED TO BE OVERLAPPING.
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MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/15/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (6.81E-04) WAS DETERMINED FROM THE SYSTEMATICS OF RADIATION WIDTH (0.11 EV) AND THE AVERAGE S-WAVE RESONANCE LEVEL SPACING (161 EV) CALCULATED FROM THE LEVEL DENSITY PARAMETERS.

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MT = 16  (N,2N) CROSS SECTION
MT = 17  (N,3N) CROSS SECTION
MT = 22  (N,N'A) CROSS SECTION
MT = 28  (N,N'P) CROSS SECTION
MT = 32  (N,N'D) CROSS SECTION
MT =103  (N,P) CROSS SECTION
MT =104  (N,D) CROSS SECTION
MT =105  (N,T) CROSS SECTION
MT =107  (N,ALPHA) CROSS SECTION
```
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 390.3) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/16/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

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  (N,P)          2.37  MB (SYSTEMATICS OF FORREST/17/)
  (N,ALPHA)      1.25  MB (SYSTEMATICS OF FORREST)
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MT = 251 MU-BAR
CALCULATED WITH CASTHY/3/.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 45.97-0.199E	R0 = 6.481	A0 = 0.62
WS = 6.502	RS = 6.926	AS = 0.35
VSO= 7.0	RSO= 6.49	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
52-TE-129	2.015E+01	5.350E-01	3.588E+00	5.141E+00	1.140E+00
52-TE-130	1.800E+01	5.470E-01	2.657E-01	5.735E+00	2.180E+00
52-TE-131	1.846E+01	5.360E-01	1.800E+00	4.651E+00	1.140E+00
52-TE-132	1.745E+01	4.920E-01	1.477E-01	4.373E+00	1.840E+00
53-I -130	1.640E+01	6.000E-01	1.297E+01	3.896E+00	0.0
53-I -131	1.600E+01	6.330E-01	2.958E+00	5.342E+00	1.040E+00
53-I -132	1.550E+01	6.000E-01	8.595E+00	3.552E+00	0.0
53-I -133	1.559E+01	4.890E-01	7.662E-01	2.691E+00	7.000E-01
54-XE-131	1.740E+01	6.000E-01	3.176E+00	5.394E+00	1.120E+00
54-XE-132	1.563E+01	6.500E-01	5.485E-01	6.600E+00	2.160E+00
54-XE-133	1.600E+01	6.250E-01	2.327E+00	5.284E+00	1.120E+00
54-XE-134	1.400E+01	6.300E-01	3.184E-01	5.224E+00	1.820E+00

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 6.392 FOR XE-133 AND 10.95 FOR XE-134.

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MAT number = 5455

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 54-XE-134 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 10.3235 KEV
    RESONANCE PARAMETERS OF JENDL-3 WERE NEWLY EVALUATED AS
    FOLLOWS :  FOUR RESONANCE LEVELS AT 2186, 6315, 7260, AND 9383
    EV WERE ADDED ON THE BASIS OF THE RECENT MEASUREMENT BY
    MACKLIN/3/.  NEUTRON WIDTH OF THE 1ST LEVEL AT 1001 EV WAS
    BASED ON JENDL-2.  NEUTRON WIDTHS FOR NEW FOUR LEVELS WERE
    DERIVED FROM THE NEUTRON CAPTURE AREA DATA BY MACKLIN AND THE
    AVERAGE RADIATION WIDTH OF 450 MEV ESTIMATED FROM THE NEUTRON
    CAPTURE AREAS.  THIS AVERAGE RADIATION WIDTH WAS ALSO ADOPTED
    FOR THE 1ST LEVEL.  NEUTRON ORBITAL ANGULAR MOMENTUM L WAS
    ASSUMED TO BE 0 FOR ALL RESONANCE LEVELS.  A NEGATIVE
    RESONANCE WAS ADDED AT -100 EV SO AS TO REPRODUCE THE THERMAL
    CAPTURE CROSS SECTION OF 265+-20 MB GIVEN BY MUGHABGHAB ET AL.
    /4/  SCATTERING RADIUS WAS ALSO TAKEN FROM THE GRAPH (FIG. 1,
    PART A) GIVEN BY MUGHABGHAB ET AL.

  UNRESOLVED RESONANCE REGION : 10.3235 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/5/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.  THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS
    OF MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.980E-4, S1 = 1.600E-4, S2 = 0.960E-4, SG = 0.278E-4,
    GG = 0.110 EV, R  = 5.385 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           3.985                   -
      ELASTIC         3.720                   -
      CAPTURE         0.2650                   0.617

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/6/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING R0 AND RSO OF IIJIMA-KAWAI POTENTIAL/7/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/8/
     ALPHA    = HUIZENGA AND IGO/9/
     DEUTERON = LOHR AND HAEBERLI/10/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/11/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/12/ WERE EVALUATED BY IIJIMA ET AL./13/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /14/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./15/

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.        0.0             0  +
            1         0.8470          2  +
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2	1.6138	2	+
3	1.7311	4	+
4	1.9196	3	+
5	1.9654	7	-
6	2.1366	5	+

LEVELS ABOVE 2.272 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/16/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (0.253E-4) WAS ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION OF 15.6 MILLI-BARNS AT 80 KEV WHICH WAS 26 % SMALLPER THAN JENDL-2/17/.

NOTE : RESULTS OF PREVIOUS INTEGRAL TEST OF JENDL-2/1,17/ WERE REFLECTED IN THE PRESENT EVALUATION.

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 294.1) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/18/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) CROSS SECTION WAS NORMALIZED TO THE FOLLOWING VALUE AT 14.5 MEV:
(N,P) 2.00 MB (RECOMMENDED BY FORREST/19/)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 45.97-0.199E	R0 = 6.481	A0 = 0.62
WS = 6.502	RS = 6.926	AS = 0.35
VSO= 7.0	RSO= 6.49	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
52-TE-130		1.800E+01	5.470E-01	2.657E-01	5.735E+00	2.180E+00
52-TE-131		1.846E+01	5.360E-01	1.800E+00	4.651E+00	1.140E+00
52-TE-132		1.745E+01	4.920E-01	1.477E-01	4.373E+00	1.840E+00
52-TE-133	*	1.516E+01	5.701E-01	7.561E-01	4.112E+00	1.140E+00
53-I -131		1.600E+01	6.330E-01	2.958E+00	5.342E+00	1.040E+00
53-I -132		1.550E+01	6.000E-01	8.595E+00	3.552E+00	0.0
53-I -133		1.559E+01	4.890E-01	7.662E-01	2.691E+00	7.000E-01
53-I -134		1.500E+01	5.600E-01	4.764E+00	2.769E+00	0.0
54-XE-132		1.563E+01	6.500E-01	5.485E-01	6.600E+00	2.160E+00
54-XE-133		1.600E+01	6.250E-01	2.327E+00	5.284E+00	1.120E+00
54-XE-134		1.400E+01	6.300E-01	3.184E-01	5.224E+00	1.820E+00
54-XE-135		1.550E+01	5.565E-01	7.506E-01	4.010E+00	1.120E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 10.95 FOR XE-134 AND 8.718 FOR XE-135.

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MAT number = 5458

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 54-XE-135 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (SLBW FORMULA) : BELOW 0.19 KEV
    RESONANCE PARAMETERS OF THE 0.084-EV RESONANCE WERE TAKEN FROM
    JENDL-2 AFTER THE FOLLOWING MODIFICATION.  RADIATION WIDTH WAS
    MODIFIED TO 101 MEV SO AS TO REPRODUCE THE THERMAL CAPTURE
    CROSS SECTION OF (2.65+-0.11)E+6 BARNS GIVEN BY MUGHABGHAB ET
    AL./3/  SCATTERING RADIUS WAS ALSO TAKEN FROM THE GRAPH (FIG.
    1, PART A) GIVEN BY MUGHABGHAB ET AL.

  UNRESOLVED RESONANCE REGION : 0.19 KEV - 100 KEV
    UNRESOLVED RESONANCE PARAMETERS WERE ADOPTED FROM JENDL-2.
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/4/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 1.040E-4, S1 = 1.580E-4, S2 = 0.990E-4, SG = 2.81E-4,
    GG = 0.110 EV, R  = 5.319 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S              RES. INTEG.
      TOTAL     2943100                         -
      ELASTIC    295500                         -
      CAPTURE   2647600                       7610

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY/4/, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/5/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING RO AND RSO OF IIJIMA-KAWAI POTENTIAL/6/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/7/
     ALPHA    = HUIZENGA AND IGO/8/
     DEUTERON = LOHR AND HAEBERLI/9/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/10/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/11/ WERE EVALUATED BY IIJIMA ET AL./12/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /13/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./14/
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NO.	ENERGY(MEV)	SPIN-PARITY
GR.	0.0	3/2 +
1	0.2885	1/2 +
2	0.5266	11/2 -
3	1.1315	7/2 +
4	1.2604	5/2 +
5	1.4483	3/2 +
6	1.4576	5/2 +
7	1.5653	9/2 +
8	1.6780	7/2 +
9	1.7814	11/2 +

10	1.7912	5/2 +
11	1.8945	7/2 -
12	1.9272	7/2 +
13	1.9683	5/2 +
14	2.0459	7/2 +
15	2.0486	11/2 -
16	2.0930	9/2 +

LEVELS ABOVE 2.112 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/15/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (2.99E-04) WAS DETERMINED FROM THE SYSTEMATICS OF RADIATION WIDTH (0.11 EV) AND AVERAGE S-WAVE RESONANCE LEVEL SPACING (368 EV).

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT = 32 (N,N'D) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 408.0) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/16/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) CROSS SECTION WAS NORMALIZED TO THE FOLLOWING VALUE AT 14.5 MEV:
(N,P) 1.31 MB (SYSTEMATICS OF FORREST/17/)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 45.97-0.199E	R0 = 6.481	A0 = 0.62
WS = 6.502	RS = 6.926	AS = 0.35
VSO= 7.0	RSO= 6.49	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
52-TE-131		1.846E+01	5.360E-01	1.800E+00	4.651E+00	1.140E+00
52-TE-132		1.745E+01	4.920E-01	1.477E-01	4.373E+00	1.840E+00
52-TE-133	*	1.516E+01	5.701E-01	7.561E-01	4.112E+00	1.140E+00
52-TE-134	*	1.340E+01	5.677E-01	8.188E-02	4.291E+00	1.990E+00
53-I -132		1.550E+01	6.000E-01	8.595E+00	3.552E+00	0.0
53-I -133		1.559E+01	4.890E-01	7.662E-01	2.691E+00	7.000E-01
53-I -134		1.500E+01	5.600E-01	4.764E+00	2.769E+00	0.0
53-I -135		1.350E+01	5.500E-01	5.307E-01	2.961E+00	8.500E-01
54-XE-133		1.600E+01	6.250E-01	2.327E+00	5.284E+00	1.120E+00
54-XE-134		1.400E+01	6.300E-01	3.184E-01	5.224E+00	1.820E+00
54-XE-135		1.550E+01	5.565E-01	7.506E-01	4.010E+00	1.120E+00
54-XE-136		1.400E+01	6.500E-01	3.270E-01	5.679E+00	1.970E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 8.718 FOR XE-135 AND 8.553 FOR XE-136.

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MAT number = 5461

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 54-XE-136 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 490 KEV
    RESONANCE PARAMETERS WERE NEWLY EVALUATED AS FOLLOWS :
    RESONANCE ENERGIES OF THE 1ST LEVEL AND OF THE OTHER LEVELS
    WERE BASED ON THE DATA MEASURED BY MACKLIN/3/ AND FOGELBERG ET
    AL./4/, RESPECTIVELY.  NEUTRON WIDTH OF THE 1ST LEVEL AT 2154
    EV WAS DERIVED FROM THE NEUTRON CAPTURE AREA MEASURED AND THE
    RADIATION WIDTH ASSUMED BY MACKLIN.  NEUTRON WIDTHS OF THE
    REMAINING 35 LEVELS FROM 18.393 TO 480.750 KEV WERE TAKEN FROM
    THE DATA BY FOGELBERG ET AL.  AVERAGE RADIATION WIDTH OF 122.5
    MEV WAS ADOPTED FOR ALL THE RESONANCE LEVELS EXCEPT THE 1ST
    AND 2ND LEVELS.  NEUTRON ORBITAL ANGULAR MOMENTUM L OF SOME
    RESONANCES WAS ESTIMATED WITH A METHOD OF BOLLINGER AND THOMAS
    /5/.  TOTAL SPIN J OF SOME RESONANCES WAS TENTATIVELY
    ESTIMATED WITH A RANDOM NUMBER METHOD.  SCATTERING RADIUS WAS
    TAKEN FROM THE GRAPH (FIG. 1, PART A) BY MUGHABGHAB ET AL./6/
    A NEGATIVE RESONANCE WAS ADDED AT -822.03 EV, AND THE ABOVE
    AVERAGE RADIATION WIDTH WAS DETERMINED SO AS TO REPRODUCE THE
    THERMAL CAPTURE CROSS SECTION OF 260+-20 MEV GIVEN BY
    MUGHABGHAB ET AL.

  NO UNRESOLVED RESONANCE REGION

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S                RES. INTEG.
      TOTAL          6.348                      -
      ELASTIC        6.088                      -
      CAPTURE        0.2600                      0.142

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 490 KEV, RESOLVED RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 490 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY/7/, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/8/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING RO AND RSO OF IIJIMA-KAWAI POTENTIAL/9/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/10/
     ALPHA    = HUIZENGA AND IGO/11/
     DEUTERON = LOHR AND HAEBERLI/12/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/13/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/14/ WERE EVALUATED BY IIJIMA ET AL./15/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /16/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./17/

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             0  +
            1        1.3132          2  +
            2        1.6947          4  +
            3        1.8920          6  +
            4        1.9200          2  +
            5        2.1080          6  +
            6        2.2620          6  +
            7        2.2897          2  +
            8        2.4148          2  +
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          9        2.4480          4  +
         10        2.5604          4  +
         11        2.6347          2  +
         12        2.8490          3  +
         13        2.8710          1  +
         14        2.9565          2  +
     LEVELS ABOVE 3.141 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/18/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (7.48E-7) WAS ADJUSTED TO
    REPRODUCE THE CAPTURE CROSS SECTION OF 0.8 MILLI-BARN AT 100
    KEV.

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE
    PEGASUS.

    THE KALBACH'S CONSTANT K (= 307.3) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/19/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,2N) CROSS SECTION WAS NORMALIZED TO THE
    FOLLOWING VALUE AT 14.5 MEV:
      (N,2N)      1750.00  MB (RECOMMENDED BY BYCHKOV+/20/)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                DEPTH (MEV)        RADIUS(FM)    DIFFUSENESS(FM)
          ----------------------   ------------  ---------------
       V  = 45.97-0.199E           R0 = 6.481    A0 = 0.62
       WS = 6.502                  RS = 6.926    AS = 0.35
       VSO= 7.0                    RSO= 6.49     ASO= 0.62
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2  LEVEL DENSITY PARAMETERS

 NUCLIDE   SYST A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
 ---------------------------------------------------------------
 52-TE-132      1.745E+01 4.920E-01 1.477E-01 4.373E+00 1.840E+00
 52-TE-133   *  1.516E+01 5.701E-01 7.561E-01 4.112E+00 1.140E+00
 52-TE-134   *  1.340E+01 5.677E-01 8.188E-02 4.291E+00 1.990E+00
 52-TE-135   *  1.498E+01 5.653E-01 6.589E-01 3.980E+00 1.140E+00

 53-I -133      1.559E+01 4.890E-01 7.662E-01 2.691E+00 7.000E-01
 53-I -134      1.500E+01 5.600E-01 4.764E+00 2.769E+00 0.0
 53-I -135      1.350E+01 5.500E-01 5.307E-01 2.961E+00 8.500E-01
 53-I -136      1.450E+01 5.500E-01 3.589E+00 2.460E+00 0.0

 54-XE-134      1.400E+01 6.300E-01 3.184E-01 5.224E+00 1.820E+00
 54-XE-135      1.550E+01 5.565E-01 7.506E-01 4.010E+00 1.120E+00
 54-XE-136      1.400E+01 6.500E-01 3.270E-01 5.679E+00 1.970E+00
 54-XE-137      1.550E+01 5.565E-01 7.470E-01 4.010E+00 1.120E+00
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  SYST:  * = LDP'S WERE DETERMINED FROM SYSTEMATICS.
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SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 8.553 FOR XE-136 AND 5.0 FOR XE-137.

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MAT number = 5525

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 55-CS-133 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-SEP90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.
92-01 COMMENTS (1,451) WERE CORRECTED.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 5.98 KEV
    RESONANCE PARAMETERS OF JENDL-2 WERE MODIFIED AS FOLLOWS :
    EVALUATION FOR JENDL-2 WAS PERFORMED ON THE BASIS OF DATA
    MEASURED BY HARVEY ET AL./3/, GARG ET AL./4/, JUNG ET AL./5/,
    THOMAS ET AL./6/, RIEHS AND THOMAS/7/, ANUFRIEV ET AL./8/ AND
    MACKLIN/9/.  TWO NEGATIVE RESONANCES WERE ADOPTED FROM
    MUGHABGHAB ET AL. /10/ AND PARAMETERS OF THE NEGATIVE AND
    LOWEST TWO RESONANCES WERE SLIGHTLY ADJUSTED SO AS TO
    REPRODUCE THE CAPTURE CROSS SECTION OF 29+-1.5 BARNS AT 0.0253
    EV AND THE NEUTRON RESONANCE CAPTURE INTEGRAL OF 437+-26 BARNS
    GIVEN BY MUGHABGHAB ET AL.  HOWEVER, THE VALUES OF TOTAL SPIN
    J FOR MOST OF RESONANCE LEVELS WERE UNKNOWN EXCEPT THE 30
    LEVELS IN THE LOW ENERGY REGION BELOW 800 EV, AND TARGET SPIN
    OF 3.5 WAS ADOPTED FOR THE ABOVE LEVELS AS THE TOTAL SPIN.

    FOR JENDL-3, RESONANCE ENERGIES BELOW 500 EV WERE SOMEWHAT
    MODIFIED BY REVIEWING THE EXPERIMENTAL DATA /3/ MENTIONED
    ABOVE, AND THE 7 RESONANCE LEVELS WERE ADDED ON THE BASIS OF
    THE MEASUREMENTS BY POPOV AND TSHETSYAK/11/, BY GARG ET AL.,
    BY ANUFRIEV ET AL., AND BY NAKJIMA ET AL./12/ THE VALUES OF
    NEUTRON ORBITAL ANGULAR MOMENTUM L WERE ASSUMED TO BE 0 FOR
    ALL THE RESONANCE LEVELS.  THE J-VALUES FOR THE J-UNKNOWN
    LEVELS WERE TENTATIVELY ESTIMATED WITH A RANDOM NUMBER METHOD.
    ACCORDING TO NEW ESTIMATION OF THE J-VALUES, NEUTRON AND
    RADIATION WIDTHS FOR MOST OF RESONANCE LEVELS WERE ALSO
    MODIFIED ON THE BASIS OF THE MEASURED DATA OF 2G*(NEUTRON
    WIDTH), TOTAL WIDTH, AND NEUTRON CAPTURE AREA.  AVERAGE
    RADIATION WIDTH OF 120.48 MEV WAS DERIVED FROM THE DATA OF
    RADIATION WIDTHS MEASURED BY MACKLIN, AND WAS ADOPTED FOR MANY
    RESONANCE LEVELS WHOSE RADIATION WIDTH WAS UNKNOWN.  NEUTRON
    AND RADIATION WIDTH FOR THE TWO NEGATIVE RESONANCE LEVELS WERE
    ALSO MODIFIED SO AS TO REPRODUCE THE THERMAL CAPTURE CROSS
    SECTION OF 29.0+-1.5 BARNS GIVEN BY MUGHABGHAB ET AL.
    SCATTERING RADIUS WAS ALSO TAKEN FROM MUGHABGHAB ET AL.

  UNRESOLVED RESONANCE REGION : 5.98 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTION S0 WAS BASED ON THE COMPILATION
    OF MUGHABGHAB ET AL., AND S1 AND S2 WERE CALCULATED WITH
    OPTICAL MODEL CODE CASTHY/13/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH GG WAS BASED ON THE COMPILATION OF
    MUGHABGHAB ET AL.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.700E-4, S1 = 1.400E-4, S2 = 1.300E-4, SG = 56.6E-4,
    GG = 0.120 EV, R  = 5.839 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL         33.30                     -
      ELASTIC        4.294                    -
      CAPTURE       29.00                   396

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/14/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED BY IGARASI ET AL./15/ TO REPRODUCE A SYSTEMATIC
  TREND OF THE TOTAL CROSS SECTION.  THE OMP'S FOR CHARGED
  PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/16/
     ALPHA    = HUIZENGA AND IGO/17/
     DEUTERON = LOHR AND HAEBERLI/18/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/19/
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    PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
    AND CAMERON/20/ WERE EVALUATED BY IIJIMA ET AL./21/  MORE
    EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
    PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
    IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
    PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
    /22/.

    MT = 1  TOTAL
      SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

    MT = 2  ELASTIC SCATTERING
      CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

    MT = 4, 51 - 91  INELASTIC SCATTERING
      SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
      ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./23/

             NO.       ENERGY(MEV)     SPIN-PARITY
             GR.        0.0             7/2 +
              1         0.0810          5/2 +
              2         0.1616          5/2 +
              3         0.3839          3/2 +
              4         0.4370          1/2 +
              5         0.6050         11/2 -
              6         0.6325         11/2 +
              7         0.6412          3/2 +
              8         0.7060          7/2 +
              9         0.7687          9/2 +
             10         0.7870          7/2 +
             11         0.8190          9/2 +
             12         0.8718          9/2 +
             13         0.9170          3/2 +
        LEVELS ABOVE 0.95 MEV WERE ASSUMED TO BE OVERLAPPING.

    MT = 102  CAPTURE
      SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
      CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
      SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
      AND REFFO/24/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

      THE GAMMA-RAY STRENGTH FUNCTION (5.28E-03) WAS ADJUSTED TO
      REPRODUCE THE CAPTURE CROSS SECTION OF 521 MILLI-BARNS AT 30
      KEV MEASURED BY YAMAMURO ET AL./25/ AND BY MACKLIN/9/.

    MT = 16  (N,2N) CROSS SECTION
    MT = 17  (N,3N) CROSS SECTION
    MT = 22  (N,N'A) CROSS SECTION
    MT = 28  (N,N'P) CROSS SECTION
    MT = 32  (N,N'D) CROSS SECTION
    MT = 33  (N,N'T) CROSS SECTION
    MT =103  (N,P) CROSS SECTION
    MT =104  (N,D) CROSS SECTION
    MT =105  (N,T) CROSS SECTION
    MT =106  (N,HE3) CROSS SECTION
    MT =107  (N,ALPHA) CROSS SECTION
      THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
      PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

      THE KALBACH'S CONSTANT K (= 262.4) WAS ESTIMATED BY THE
      FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/26/ AND LEVEL
      DENSITY PARAMETERS.

      FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
      NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
        (N,P)          10.50  MB (RECOMMENDED BY FORREST/27/)
        (N,ALPHA)       1.60  MB (RECOMMENDED BY FORREST)

    MT = 251  MU-BAR
      CALCULATED WITH CASTHY.

  MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
    LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
    GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
    TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
    CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
    BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

  MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
    ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
    PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
    OTHER NEUTRON EMITTING REACTIONS.
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TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

	DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
	V = 46.0-0.25E	R0 = 6.521	A0 = 0.62
	WI = 0.125E-0.0004E**2	RI = 6.521	AI = 0.62
	WS = 7.0	RS = 7.021	AS = 0.35
	VSO= 7.0	RSO= 6.521	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
53-I -129		1.720E+01	6.200E-01	3.436E+00	5.762E+00	1.200E+00
53-I -130		1.640E+01	6.000E-01	1.297E+01	3.896E+00	0.0
53-I -131		1.600E+01	6.330E-01	2.958E+00	5.342E+00	1.040E+00
53-I -132		1.550E+01	6.000E-01	8.595E+00	3.552E+00	0.0
54-XE-130		1.671E+01	6.600E-01	8.841E-01	7.427E+00	2.320E+00
54-XE-131		1.740E+01	6.000E-01	3.176E+00	5.394E+00	1.120E+00
54-XE-132		1.563E+01	6.500E-01	5.485E-01	6.600E+00	2.160E+00
54-XE-133		1.600E+01	6.250E-01	2.327E+00	5.284E+00	1.120E+00
55-CS-131	*	1.705E+01	5.750E-01	1.633E+00	4.913E+00	1.200E+00
55-CS-132	*	1.676E+01	5.726E-01	1.123E+01	3.569E+00	0.0
55-CS-133		1.750E+01	6.000E-01	3.784E+00	5.352E+00	1.040E+00
55-CS-134		1.598E+01	6.450E-01	1.710E+01	4.505E+00	0.0

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 8.076 FOR CS-133 AND 11.67 FOR CS-134.

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MAT number = 5528

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 55-CS-134 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 0.179 KEV
    RESONANCE ENERGIES, NEUTRON WIDTHS, RADIATION WIDTHS, AND
    AVERAGE RADIATION WIDTH WERE BASED ON MUGHABGHAB ET AL./2/
    AVERAGE RADIATION WIDTH OF 160 MEV WAS ADOPTED FOR THE
    RESONANCE LEVELS WHOSE RADIATION WIDTH WAS UNKNOWN.  THE VALUE
    OF NEUTRON ORBITAL ANGULAR MOMENTUM L WAS ASSUMED TO BE 0 FOR
    ALL RESONANCE LEVELS.  THE VALUES OF TOTAL SPIN J FOR ALL
    RESONANCE LEVELS WERE TENTATIVELY ESTIMATED WITH A RANDOM
    NUMBER METHOD.  SCATTERING RADIUS WAS TAKEN FROM THE GRAPH
    (FIG. 1, PART A) GIVEN BY MUGHABGHAB ET AL.  A NEGATIVE
    RESONANCE WAS ADDED SO AS TO REPRODUCE THE THERMAL CAPTURE
    CROSS SECTION OF 140+-12 BARNS GIVEN BY MUGHABGHAB ET AL.

  UNRESOLVED RESONANCE REGION : 0.179 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/3/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.  THE RADIATION WIDTH GG WAS BASED ON THE COMPILATION
    OF MUGHABGHAB ET AL.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 1.400E-4, S1 = 1.300E-4, S2 = 1.300E-4, SG = 262.E-4,
    GG = 0.160 EV, R  = 5.318 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                    2200 M/S                RES. INTEG.
      TOTAL        162.3                      -
      ELASTIC       22.64                     -
      CAPTURE      139.7                     106

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/4/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED BY IGARASI ET AL./5/ TO REPRODUCE A SYSTEMATIC TREND
  OF THE TOTAL CROSS SECTION.  THE OMP'S FOR CHARGED PARTICLES ARE
  AS FOLLOWS:
     PROTON   = PEREY/6/
     ALPHA    = HUIZENGA AND IGO/7/
     DEUTERON = LOHR AND HAEBERLI/8/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/9/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/10/ WERE EVALUATED BY IIJIMA ET AL./11/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /12/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/13/ AND NUCLEAR DATA
    SHEETS/14/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             4  +
            1        0.0112          5  +
            2        0.0600          3  +
```

3	0.1388	8	-
4	0.1738	3	+
5	0.1764	3	-
6	0.1766	1	+
7	0.1903	4	+
8	0.1937	4	-
9	0.1978	3	+
10	0.2096	4	+
11	0.2343	3	+
12	0.2571	6	-
13	0.2677	5	-
14	0.2714	3	+
15	0.2910	2	+
16	0.3444	7	-
17	0.3771	3	+
18	0.3831	6	-
19	0.4342	7	-
20	0.4503	5	-
21	0.4514	2	+
22	0.4541	4	+
23	0.4837	3	-
24	0.5028	3	+
25	0.5193	3	+
26	0.5709	4	-
27	0.5792	2	+
28	0.6240	6	-
29	0.6345	5	-

LEVELS ABOVE 0.684 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/15/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (2.58E-02) WAS DETERMINED FROM THE SYSTEMATICS OF RADIATION WIDTH (0.16 EV) AND THE AVERAGE S-WAVE RESONANCE LEVEL SPACING (6.18 EV) CALCULATED FROM THE LEVEL DENSITY PARAMETERS.

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT = 32 (N,N'D) CROSS SECTION
MT = 33 (N,N'T) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =106 (N,HE3) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 452.1) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/16/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,P)	3.76 MB	(SYSTEMATICS OF FORREST/17/)
(N,ALPHA)	1.82 MB	(SYSTEMATICS OF FORREST)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

	DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)

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V   = 46.0-0.25E              R0 = 6.536    A0 = 0.62
WI  = 0.125E-0.0004E**2       RI = 6.536    AI = 0.62
WS  = 7.0                     RS = 7.036    AS = 0.35
VSO= 7.0                      RSO= 6.536    ASO= 0.62
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THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
53-I -130		1.640E+01	6.000E-01	1.297E+01	3.896E+00	0.0
53-I -131		1.600E+01	6.330E-01	2.958E+00	5.342E+00	1.040E+00
53-I -132		1.550E+01	6.000E-01	8.595E+00	3.552E+00	0.0
53-I -133		1.559E+01	4.890E-01	7.662E-01	2.691E+00	7.000E-01
54-XE-131		1.740E+01	6.000E-01	3.176E+00	5.394E+00	1.120E+00
54-XE-132		1.563E+01	6.500E-01	5.485E-01	6.600E+00	2.160E+00
54-XE-133		1.600E+01	6.250E-01	2.327E+00	5.284E+00	1.120E+00
54-XE-134		1.400E+01	6.300E-01	3.184E-01	5.224E+00	1.820E+00
55-CS-132	*	1.676E+01	5.726E-01	1.123E+01	3.569E+00	0.0
55-CS-133		1.750E+01	6.000E-01	3.784E+00	5.352E+00	1.040E+00
55-CS-134		1.598E+01	6.450E-01	1.710E+01	4.505E+00	0.0
55-CS-135		1.343E+01	6.537E-01	1.831E+00	4.203E+00	7.000E-01

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 11.67 FOR CS-134 AND 4.75 FOR CS-135.

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MAT number = 5531
 55-CS-135 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 0.088 KEV
    RESONANCE PARAMETERS OF JENDL-2 WERE MODIFIED AS FOLLOWS :
    EVALUATION FOR JENDL-2 WAS PERFORMED ON THE BASIS OF THE DATA
    (ONLY ONE POSITIVE LEVEL) MEASURED BY PRIESMEYER ET AL./3/
    A NEGATIVE RESONANCE WAS ADDED AT -50 EV.  THE PARAMETERS WERE
    ADJUSTED SO AS TO REPRODUCE THE CAPTURE CROSS SECTION OF
    8.7+-0.5 BARNS AT 0.0253 EV AND THE NEUTRON RESONANCE CAPTURE
    INTEGRAL OF 62+-2 BARNS GIVEN BY MUGHABGHAB ET AL./4/ SINCE
    THE VALUES OF TOTAL SPIN J FOR THE NEGATIVE AND POSITIVE FIRST
    LEVELS WERE UNKNOWN, THE TARGET SPIN OF 3.5 WAS ADOPTED AS THE
    TOTAL SPIN.

    FOR JENDL-3, THE J-VALUES OF THE BOTH LEVELS WERE TENTATIVELY
    ESTIMATED WITH A RANDOM NUMBER METHOD.  NEUTRON WIDTHS FOR THE
    BOTH LEVELS WERE MODIFIED SO AS TO REPRODUCE THE THERMAL
    CAPTURE CROSS SECTION AND THE NEUTRON RESONANCE CAPTURE
    INTEGRAL MENTIONED ABOVE.  RADIATION WIDTHS AND SCATTERING
    RADIUS WERE TAKEN FROM JENDL-2.

  UNRESOLVED RESONANCE REGION : 0.088 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/5/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.  THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS
    OF MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 1.500E-4, S1 = 1.200E-4, S2 = 1.400E-4, SG = 13.5E-4,
    GG = 0.100 EV, R  = 5.293 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                   2200 M/S               RES. INTEG.
      TOTAL       13.55                     -
      ELASTIC      4.850                    -
      CAPTURE      8.702                   62.5

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/6/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED BY IGARASI ET AL./7/ TO REPRODUCE A SYSTEMATIC TREND
  OF THE TOTAL CROSS SECTION.  THE OMP'S FOR CHARGED PARTICLES ARE
  AS FOLLOWS:
     PROTON   = PEREY/8/
     ALPHA    = HUIZENGA AND IGO/9/
     DEUTERON = LOHR AND HAEBERLI/10/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/11/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/12/ WERE EVALUATED BY IIJIMA ET AL./13/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /14/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./15/
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NO.	ENERGY(MEV)	SPIN-PARITY
GR.	0.0	7/2 +
1	0.2498	5/2 +
2	0.4080	3/2 +
3	0.6082	5/2 +
4	0.7869	7/2 +

LEVELS ABOVE 0.981 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/16/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (1.38E-03) WAS DETERMINED FROM THE SYSTEMATICS OF RADIATION WIDTH (0.125 EV) AND THE AVERAGE S-WAVE RESONANCE LEVEL SPACING (90.8 EV) CALCULATED FROM THE LEVEL DENSITY PARAMETERS.

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT = 32 (N,N'D) CROSS SECTION
MT = 33 (N,N'T) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 408.0) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/17/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
(N,P) 2.81 MB (SYSTEMATICS OF FORREST/18/)
(N,ALPHA) 1.41 MB (SYSTEMATICS OF FORREST)

MT = 251 MU-BAR
CALCULATED WITH CASTHY/5/.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

	DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V	= 46.0-0.25E	R0 = 6.551	A0 = 0.62
WI	= 0.125E-0.0004E**2	RI = 6.551	AI = 0.62
WS	= 7.0	RS = 7.051	AS = 0.35
VSO	= 7.0	RSO= 6.551	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
53-I -131	1.600E+01	6.330E-01	2.958E+00	5.342E+00	1.040E+00
53-I -132	1.550E+01	6.000E-01	8.595E+00	3.552E+00	0.0
53-I -133	1.559E+01	4.890E-01	7.662E-01	2.691E+00	7.000E-01
53-I -134	1.500E+01	5.600E-01	4.764E+00	2.769E+00	0.0
54-XE-132	1.563E+01	6.500E-01	5.485E-01	6.600E+00	2.160E+00
54-XE-133	1.600E+01	6.250E-01	2.327E+00	5.284E+00	1.120E+00
54-XE-134	1.400E+01	6.300E-01	3.184E-01	5.224E+00	1.820E+00
54-XE-135	1.550E+01	5.565E-01	7.506E-01	4.010E+00	1.120E+00
55-CS-133	1.750E+01	6.000E-01	3.784E+00	5.352E+00	1.040E+00
55-CS-134	1.598E+01	6.450E-01	1.710E+01	4.505E+00	0.0

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 55-CS-135     1.343E+01 6.537E-01 1.831E+00 4.203E+00 7.000E-01
 55-CS-136     1.400E+01 6.000E-01 4.424E+00 2.967E+00 0.0
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SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 4.75 FOR CS-135 AND 5.0 FOR CS-136.

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MAT number = 5534

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 55-CS-136 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  NO RESOLVED RESONANCE PARAMETERS

  UNRESOLVED RESONANCE REGION : 29 EV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/2/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 1.600E-4, S1 = 1.200E-4, S2 =   1.5E-4, SG = 15.6E-4,
    GG = 0.095 EV, R  = 5.202 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL          16.50                     -
      ELASTIC         3.500                    -
      CAPTURE        13.00                    57.4

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 29 EV, THE CAPTURE AND ELASTIC SCATTERING CROSS SECTIONS
  WERE ASSUMED TO BE IN 1/V FORM AND CONSTANT, RESPECTIVELY.
  CAPTURE CROSS SECTION AT 0.0253 EV WAS DETERMINED BY THE
  SYSTEMATICS FROM THE NEIGHBORING NUCLIDES.  UNRESOLVED RESONANCE
  PARAMETERS WERE GIVEN IN THE ENERGY RANGE FROM 29 EV TO 100 KEV.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/3/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED BY IGARASI ET AL./4/ TO REPRODUCE A SYSTEMATIC TREND
  OF THE TOTAL CROSS SECTION.  THE OMP'S FOR CHARGED PARTICLES ARE
  AS FOLLOWS:
     PROTON   = PEREY/5/
     ALPHA    = HUIZENGA AND IGO/6/
     DEUTERON = LOHR AND HAEBERLI/7/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/8/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/9/ WERE EVALUATED BY IIJIMA ET AL./10/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /11/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/12/ AND NUCLEAR DATA
    SHEETS/13/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.        0.0             5  +
      LEVELS ABOVE 0.05 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/14/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (1.64E-03) WAS DETERMINED FROM
    THE SYSTEMATICS OF RADIATION WIDTH (0.095 EV) AND THE AVERAGE
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    S-WAVE RESONANCE LEVEL SPACING (58 EV) CALCULATED FROM THE
    LEVEL DENSITY PARAMETERS.

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT = 32  (N,N'D) CROSS SECTION
  MT = 33  (N,N'T) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (= 479.9) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/15/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,P)          2.10  MB (SYSTEMATICS OF FORREST/16/)
      (N,ALPHA)      1.09  MB (SYSTEMATICS OF FORREST)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                 DEPTH (MEV)        RADIUS(FM)    DIFFUSENESS(FM)
          ----------------------   ------------   ---------------
        V  = 46.0-0.25E            R0 = 6.566     A0 = 0.62
        WI = 0.125E-0.0004E**2     RI = 6.566     AI = 0.62
        WS = 7.0                   RS = 7.065     AS = 0.35
        VSO= 7.0                   RSO= 6.566     ASO= 0.62
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2  LEVEL DENSITY PARAMETERS

 NUCLIDE       A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
 ---------------------------------------------------------------
 53-I -132     1.550E+01 6.000E-01 8.595E+00 3.552E+00 0.0
 53-I -133     1.559E+01 4.890E-01 7.662E-01 2.691E+00 7.000E-01
 53-I -134     1.500E+01 5.600E-01 4.764E+00 2.769E+00 0.0
 53-I -135     1.350E+01 5.500E-01 5.307E-01 2.961E+00 8.500E-01

 54-XE-133     1.600E+01 6.250E-01 2.327E+00 5.284E+00 1.120E+00
 54-XE-134     1.400E+01 6.300E-01 3.184E-01 5.224E+00 1.820E+00
 54-XE-135     1.550E+01 5.565E-01 7.506E-01 4.010E+00 1.120E+00
 54-XE-136     1.400E+01 6.500E-01 3.270E-01 5.679E+00 1.970E+00

 55-CS-134     1.598E+01 6.450E-01 1.710E+01 4.505E+00 0.0
 55-CS-135     1.343E+01 6.537E-01 1.831E+00 4.203E+00 7.000E-01
 55-CS-136     1.400E+01 6.000E-01 4.424E+00 2.967E+00 0.0
 55-CS-137     1.336E+01 6.200E-01 9.986E-01 3.836E+00 8.500E-01
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 SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
 IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
 ASSUMED TO BE 5.0 FOR CS-136 AND 4.571 FOR CS-137.

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MAT number = 5537
 55-CS-137 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-SEP90 REV2-MAR93
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.
93-03 JENDL-3.2 WAS MADE BY JNDC FPND W.G.

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)       ALL RESOLVED RESONANCES WERE DELETED.
      (3,1), (3,2), (3102)
                    BELOW 1.7 KEV
     ***********************************************************


MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 UNRESOLVED RESONANCE PARAMETERS
    RESOLVED RESONANCE PARAMETERS GIVEN IN JENDL-3.1 WERE DELETED.
    ONLY UNRESOLVED RESONANCE PARAMETERS WERE GIVEN.  THE LOWER
    ENERGY BOUNDARY WAS DETERMINED SO AS TO REPRODUCE THE CAPTURE
    RESONANCE INTEGRAL OF 0.35+-0.07 B MEASURED BY HARADA ET AL.
    /3/

  UNRESOLVED RESONANCE REGION : 1.70 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/4/.
    THE OBSERVED LEVEL SPACING WAS DETERMINED TO REPRODUCE THE
    CAPTURE CROSS SECTION CALCULATED WITH CASTHY.  THE EFFECTIVE
    SCATTERING RADIUS WAS OBTAINED FROM FITTING TO THE CALCULATED
    TOTAL CROSS SECTION AT 100 KEV.  THE RADIATION WIDTH GG WAS
    BASED ON THE SYSTEMATICS OF MEASURED VALUES FOR NEIGHBORING
    NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 1.800E-4, S1 = 1.100E-4, S2 = 1.600E-4, SG = 0.801E-4,
    GG = 0.090 EV, R  = 5.101 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           3.780                     -
      ELASTIC         3.530                     -
      CAPTURE         0.250                      0.357

MF = 3  NEUTRON CROSS SECTIONS

- BELOW 1.7 KEV:  THE ELASTIC SCATTRING CROSS SECTION IS
  CALCULATED FROM R = 5.3 FM.  THE CAPTURE CROSS SECTION IS IN
  THE FORM OF 1/V AND 0.250 B AT 0.0253 EV/3/.  THE TOTAL CROSS
  SECTION IS SUM OF THESE TWO.

- BETWEEN 1.7 KEV AND 100 KEV: URP GIVEN.

- ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/5/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED BY IGARASI ET AL./6/ TO REPRODUCE A SYSTEMATIC TREND
  OF THE TOTAL CROSS SECTION.  THE OMP'S FOR CHARGED PARTICLES
  ARE AS FOLLOWS:
     PROTON   = PEREY/7/
     ALPHA    = HUIZENGA AND IGO/8/
     DEUTERON = LOHR AND HAEBERLI/9/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/10/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/11/ WERE EVALUATED BY IIJIMA ET AL./12/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /13/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
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    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./14/

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0            7/2 +
            1        0.4560         5/2 +
            2        0.8490         3/2 +
            3        0.9800         5/2 +
            4        1.4900         1/2 +
            5        1.8700        11/2 -
            6        2.0700         3/2 +
            7        2.1500         1/2 +
      LEVELS ABOVE 2.3 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/15/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (9.13E-05) WAS DETERMINED FROM
    THE SYSTEMATICS OF RADIATION WIDTH (0.125 EV) AND AVERAGE
    S-WAVE RESONANCE LEVEL SPACING (1370 EV).

    NOTE: INTEGRAL CAPTURE CROSS SECTION OF 90(+-25%) MB/16/
          MEASURED IN CFRMF COULD NOT BE REPRODUCED.  AVERAGE
          CROSS SECTION CALCULATED FROM PRESENT DATA IS 9.7 MB.

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT = 32  (N,N'D) CROSS SECTION
  MT = 33  (N,N'T) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (= 368.2) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/17/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,P)           1.57  MB (SYSTEMATICS OF FORREST/18/)
      (N,ALPHA)       0.85  MB (SYSTEMATICS OF FORREST)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
         ----------------------   ------------  ---------------
        V  = 46.0-0.25E           R0 = 6.58     A0 = 0.62
        WI = 0.125E-0.0004E**2    RI = 6.58     AI = 0.62
        WS = 7.0                  RS = 7.08     AS = 0.35
        VSO= 7.0                  RSO= 6.58     ASO= 0.62
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2  LEVEL DENSITY PARAMETERS

 NUCLIDE       A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
 ---------------------------------------------------------------
 53-I -133     1.559E+01 4.890E-01 7.662E-01 2.691E+00 7.000E-01
 53-I -134     1.500E+01 5.600E-01 4.764E+00 2.769E+00 0.0
 53-I -135     1.350E+01 5.500E-01 5.307E-01 2.961E+00 8.500E-01
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53-I -136	1.450E+01	5.500E-01	3.589E+00	2.460E+00	0.0
54-XE-134	1.400E+01	6.300E-01	3.184E-01	5.224E+00	1.820E+00
54-XE-135	1.550E+01	5.565E-01	7.506E-01	4.010E+00	1.120E+00
54-XE-136	1.400E+01	6.500E-01	3.270E-01	5.679E+00	1.970E+00
54-XE-137	1.550E+01	5.565E-01	7.470E-01	4.010E+00	1.120E+00
55-CS-135	1.343E+01	6.537E-01	1.831E+00	4.203E+00	7.000E-01
55-CS-136	1.400E+01	6.000E-01	4.424E+00	2.967E+00	0.0
55-CS-137	1.336E+01	6.200E-01	9.986E-01	3.836E+00	8.500E-01
55-CS-138	1.470E+01	5.737E-01	4.715E+00	2.858E+00	0.0

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 4.571 FOR CS-137 AND 5.0 FOR CS-138.

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MAT number = 5625

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 56-BA-130 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 2.53 KEV
    RESONANCE PARAMETERS WERE BASED ON MUGHABGHAB ET AL./2/ A
    NEGATIVE RESONANCE WAS ADDED SO AS TO REPRODUCE THE THERMAL
    CAPTURE CROSS SECTION GIVEN BY MUGHABGHAB ET AL.  NEUTRON
    ORBITAL ANGULAR MOMENTUM L WAS ASSUMED TO BE 0 FOR ALL THE
    RESONANCES.  AVERAGE RADIATION WIDTH WAS TAKEN FROM MUGHABGHAB
    ET AL. AND SCATTERING RADIUS WAS DETERMINED FROM OPTICAL MODEL
    CALCULATION WITH CASTHY/3/.

  UNRESOLVED RESONANCE REGION : 2.53 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTION S0 WAS BASED ON THE COMPILATION
    OF MUGHABGHAB ET AL., AND S1 AND S2 WERE CALCULATED WITH
    OPTICAL MODEL CODE CASTHY/3/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE GAMMA WIDTH GG WAS BASED ON THE COMPILATION OF MUGHABGHAB
    ET AL.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 1.300E-4, S1 = 0.890E-4, S2 = 0.600E-4, SG = 54.5E-4,
    GG = 0.100 EV, R  = 4.562 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL          14.42                    -
      ELASTIC         3.126                   -
      CAPTURE        11.29                  177

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/4/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING WS AND RSO OF IIJIMA-KAWAI POTENTIAL/5/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/6/
     ALPHA    = HUIZENGA AND IGO/7/
     DEUTERON = LOHR AND HAEBERLI/8/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/9/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/10/ WERE EVALUATED BY IIJIMA ET AL./11/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /12/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/13/ AND NUCLEAR DATA
    SHEETS/14/.

           NO.      ENERGY(MEV)    SPIN-PARITY   DWBA CAL.
           GR.       0.0             0  +
            1        0.3573          2  +            *
            2        0.9017          4  +
            3        0.9079          2  +
            4        1.3609          4  +
            5        1.4774          4  +
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          6        1.5573          2  +
          7        1.5928          6  +
    LEVELS ABOVE 1.844 MEV WERE ASSUMED TO BE OVERLAPPING.

    FOR THE LEVELS WITH AN ASTERISK, THE CONTRIBUTION OF DIRECT
    INELASTIC SCATTERING CROSS SECTIONS WAS CALCULATED BY THE
    DWUCK-4 CODE/15/.  DEFORMATION PARAMETER (BETA2 = 0.230) WAS
    BASED ON THE DATA COMPILED BY RAMAN ET AL./16/

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/17/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (6.84E-03) WAS ADJUSTED TO
    REPRODUCE THE CAPTURE CROSS SECTION OF 750 MILLI-BARNS AT 25
    KEV MEASURED BY BRADLEY ET AL./18/

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT = 32  (N,N'D) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =106  (N,HE3) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
  MT =111  (N,2P) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (= 127.0) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/19/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,2N), (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,2N)      1380.00  MB (SYSTEMATICS OF WEN DEN LU+/20/)
      (N,P)         24.60  MB (SYSTEMATICS OF FORREST/21/)
      (N,ALPHA)     10.10  MB (SYSTEMATICS OF FORREST)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  CONTRIBUTION OF DIRECT INELASTIC
  SCATTERING WAS CALCULATED WITH DWUCK-4.  FOR OTHER REACTIONS,
  ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

              DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
         ----------------------  ------------  ---------------
        V  = 41.8                R0 = 6.89     A0 = 0.62
        WS = 2.95+0.789E         RS = 7.098    AS = 0.35
        VSO= 7.0                 RSO= 6.89     ASO= 0.62
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2  LEVEL DENSITY PARAMETERS

 NUCLIDE  SYST A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
 -------------------------------------------------------------
 54-XE-126     1.908E+01 6.110E-01 8.260E-01 7.676E+00 2.550E+00
 54-XE-127     1.982E+01 5.420E-01 3.686E+00 5.152E+00 1.120E+00
 54-XE-128     1.800E+01 5.830E-01 5.017E-01 6.396E+00 2.210E+00
 54-XE-129     1.936E+01 5.729E-01 5.108E+00 5.590E+00 1.120E+00

 55-CS-127  *  1.818E+01 5.847E-01 2.138E+00 5.710E+00 1.430E+00
 55-CS-128  *  1.791E+01 5.822E-01 2.111E+01 4.140E+00 0.0
 55-CS-129  *  1.763E+01 5.798E-01 2.754E+00 5.088E+00 1.090E+00
 55-CS-130  *  1.735E+01 5.774E-01 1.541E+01 3.856E+00 0.0
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56-BA-128	*	1.832E+01	5.822E-01	1.449E-01	7.297E+00	3.010E+00
56-BA-129		1.978E+01	6.490E-01	1.150E+01	7.812E+00	1.580E+00
56-BA-130		1.850E+01	6.240E-01	6.573E-01	7.832E+00	2.670E+00
56-BA-131		1.990E+01	6.090E-01	5.764E+00	6.979E+00	1.580E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 8.696 FOR BA-130 AND 5.0 FOR BA-131.

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MAT number = 5631

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 56-BA-132 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  NO RESOLVED RESONANCE PARAMETERS
    ONLY RESONANCE ENERGIES WERE AVAILABLE/2/.

  UNRESOLVED RESONANCE REGION : 68 EV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/3/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.  THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS
    OF MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.510E-4, S1 = 0.880E-4, S2 = 0.590E-4, SG = 24.3E-4,
    GG = 0.120 EV, R  = 5.308 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S                RES. INTEG.
      TOTAL          10.30                     -
      ELASTIC         3.300                    -
      CAPTURE         7.000                   31.3

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 68 EV, THE CAPTURE AND ELASTIC SCATTERING CROSS SECTIONS
  WERE ASSUMED TO BE IN 1/V FORM AND CONSTANT, RESPECTIVELY.  THE
  CAPTURE CROSS SECTION AT 0.0253 EV WAS TAKEN FROM REF./2/, AND
  THE ELASTIC SCATTERING CROSS SECTION WAS ESTIMATED BY ASSUMING
  R = 5.2 FM.  UNRESOLVED RESONANCE PARAMETERS WERE GIVEN IN THE
  ENERGY RANGE FROM 68 EV TO 100 KEV.

  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/4/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING WS AND RSO OF IIJIMA-KAWAI POTENTIAL/5/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/6/
     ALPHA    = HUIZENGA AND IGO/7/
     DEUTERON = LOHR AND HAEBERLI/8/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/9/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/10/ WERE EVALUATED BY IIJIMA ET AL./11/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /12/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/13/ AND NUCLEAR DATA
    SHEETS/14/.

           NO.      ENERGY(MEV)    SPIN-PARITY   DWBA CAL.
           GR.      0.0              0  +
            1       0.4646           2  +            *
            2       1.0317           2  +
            3       1.1276           4  +
            4       1.5030           0  +
            5       1.5112           3  +
            6       1.6858           2  +
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           7        1.7294          4  +
           8        1.9328          6  +
           9        1.9982          1  +
          10        2.0270          3  -          *
      LEVELS ABOVE 2.046 MEV WERE ASSUMED TO BE OVERLAPPING.

    FOR THE LEVELS WITH AN ASTERISK, THE CONTRIBUTION OF DIRECT
    INELASTIC SCATTERING CROSS SECTIONS WAS CALCULATED BY THE
    DWUCK-4 CODE/15/.  DEFORMATION PARAMETERS (BETA2 = 0.186 AND
    BETA3 = 0.070) WERE BASED ON THE DATA COMPILED BY RAMAN ET
    AL./16/ AND SPEAR/17/, RESPECTIVELY.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/18/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (2.387E-03) WAS DETERMINED
    FROM THE SYSTEMATICS.


  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =106  (N,HE3) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (= 143.0) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/19/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,2N), (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,2N)      1600.00  MB (RECOMMENDED BY BYCHKOV+/20/)
      (N,P)         13.90  MB (SYSTEMATICS OF FORREST/21/)
      (N,ALPHA)      4.84  MB (SYSTEMATICS OF FORREST)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY/3/.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  CONTRIBUTION OF DIRECT INELASTIC
  SCATTERING WAS CALCULATED WITH DWUCK-4.  FOR OTHER REACTIONS,
  ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
         ----------------------   ------------  ---------------
        V  = 41.8                 R0 = 6.89     A0 = 0.62
        WS = 2.95+0.789E          RS = 7.098    AS = 0.35
        VSO= 7.0                  RSO= 6.89     ASO= 0.62
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2  LEVEL DENSITY PARAMETERS

 NUCLIDE  SYST A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
 ---------------------------------------------------------------
 54-XE-128      1.800E+01 5.830E-01 5.017E-01 6.396E+00 2.210E+00
 54-XE-129      1.936E+01 5.729E-01 5.108E+00 5.590E+00 1.120E+00
 54-XE-130      1.671E+01 6.600E-01 8.841E-01 7.427E+00 2.320E+00
 54-XE-131      1.740E+01 6.000E-01 3.176E+00 5.394E+00 1.120E+00

 55-CS-129   *  1.763E+01 5.798E-01 2.754E+00 5.088E+00 1.090E+00
 55-CS-130   *  1.735E+01 5.774E-01 1.541E+01 3.856E+00 0.0
 55-CS-131   *  1.705E+01 5.750E-01 1.633E+00 4.913E+00 1.200E+00
 55-CS-132   *  1.676E+01 5.726E-01 1.123E+01 3.569E+00 0.0
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56-BA-130     1.850E+01 6.240E-01 6.573E-01 7.832E+00 2.670E+00
56-BA-131     1.990E+01 6.090E-01 5.764E+00 6.979E+00 1.580E+00
56-BA-132     1.850E+01 6.360E-01 6.996E-01 8.187E+00 2.780E+00
56-BA-133     1.941E+01 5.930E-01 3.357E+00 6.465E+00 1.580E+00
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 SYST:  * = LDP'S WERE DETERMINED FROM SYSTEMATICS.
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SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 6.425 FOR BA-132 AND 5.0 FOR BA-133.

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MAT number = 5637

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 56-BA-134 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE PARAMETERS FOR MLBW FORMULA (BELOW 10.575KEV)
    EVALUATION FOR JENDL-2 MADE BY KIKUCHI/3/ WAS ADOPTED ALSO FOR
    JENDL-3.  FOR THE RESONANCES BELOW 1.9 KEV, NEUTRON WIDTHS
    WERE DETERMINED FROM THE DATA OF ALVES ET AL./4/ AND VAN DE
    VYVER AND PATTENDEN/5/.  ABOVE 3 KEV, PARAMETERS WERE
    EVALUATED ON THE BASIS OF THE DATA OF MUSGROVE ET AL./6/  IN
    THE ENERGY RANGE FROM 1.6 TO 3 KEV, ARTIFICIAL RESONANCES WERE
    GENERATED WITH STAT/7/ BY ASSUMING D = 127 EV, S0 = 0.85E-4,
    S1 = 0.8E-4 AND THE AVERAGE RADIATION WIDTH OF 0.120 EV/8/.  A
    NEGATIVE RESONANCE WAS ADDED SO AS TO REPRODUCE THE CAPTURE
    CROSS SECTION OF 2.0+-1.6 BARNS AT 0.0253 EV/8/.  SCATTERING
    RADIUS WAS DETERMINED FROM SYSTEMATICS.

  UNRESOLVED RESONANCE REGION : 10.575 KEV - 100 KEV
    UNRESOLVED RESONANCE PARAMETERS WERE ADOPTED FROM JENDL-2.
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/9/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.600E-4, S1 = 0.900E-4, S2 = 0.550E-4, SG = 7.72E-4,
    GG = 0.178 EV, R  = 5.193 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           5.428                   -
      ELASTIC         3.427                   -
      CAPTURE         2.002                  24.8

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/10/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING WS AND RSO OF IIJIMA-KAWAI POTENTIAL/11/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/12/
     ALPHA    = HUIZENGA AND IGO/13/
     DEUTERON = LOHR AND HAEBERLI/14/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/15/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/16/ WERE EVALUATED BY IIJIMA ET AL./17/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /18/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./19/.

           NO.      ENERGY(MEV)    SPIN-PARITY    DWBA CAL.
           GR.       0.0             0  +
            1        0.6047          2  +            *
            2        1.1679          2  +
            3        1.4006          4  +
            4        1.6433          3  +
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5	1.7605	0	+	
6	1.9699	4	+	
7	2.0292	2	+	
8	2.0883	2	+	
9	2.1597	0	+	
10	2.2546	3	-	*
11	2.3368	0	+	
12	2.3791	0	+	
13	2.4886	0	+	

LEVELS ABOVE 2.54 MEV WERE ASSUMED TO BE OVERLAPPING.

FOR THE LEVELS WITH AN ASTERISK, THE CONTRIBUTION OF DIRECT INELASTIC SCATTERING CROSS SECTIONS WAS CALCULATED BY THE DWUCK-4 CODE/20/. DEFORMATION PARAMETERS (BETA2 = 0.1636 AND BETA3 = 0.080) WERE BASED ON THE DATA COMPILED BY RAMAN ET AL./21/ AND SPEAR/22/, RESPECTIVELY.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/23/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (7.70E-04) WAS ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION OF 160 MILLI-BARNS AT 70 KEV MEASURED BY MUSGROVE ET AL./24/

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 159.2) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/25/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,2N), (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,2N)	1590.00	MB	(SYSTEMATICS OF WEN DEN LU+/26/)
(N,P)	7.84	MB	(SYSTEMATICS OF FORREST/27/)
(N,ALPHA)	3.43	MB	(SYSTEMATICS OF FORREST)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. CONTRIBUTION OF DIRECT INELASTIC SCATTERING WAS CALCULATED WITH DWUCK-4. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 41.8	R0 = 6.89	A0 = 0.62
WS = 2.95+0.789E	RS = 7.098	AS = 0.35
VSO= 7.0	RSO= 6.89	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
54-XE-130		1.671E+01	6.600E-01	8.841E-01	7.427E+00	2.320E+00
54-XE-131		1.740E+01	6.000E-01	3.176E+00	5.394E+00	1.120E+00
54-XE-132		1.563E+01	6.500E-01	5.485E-01	6.600E+00	2.160E+00
54-XE-133		1.600E+01	6.250E-01	2.327E+00	5.284E+00	1.120E+00

55-CS-131	*	1.705E+01	5.750E-01	1.633E+00	4.913E+00	1.200E+00
55-CS-132	*	1.676E+01	5.726E-01	1.123E+01	3.569E+00	0.0
55-CS-133		1.750E+01	6.000E-01	3.784E+00	5.352E+00	1.040E+00
55-CS-134		1.598E+01	6.450E-01	1.710E+01	4.505E+00	0.0
56-BA-132		1.850E+01	6.360E-01	6.996E-01	8.187E+00	2.780E+00
56-BA-133		1.941E+01	5.930E-01	3.357E+00	6.465E+00	1.580E+00
56-BA-134		1.800E+01	6.100E-01	4.177E-01	7.309E+00	2.620E+00
56-BA-135		1.902E+01	5.820E-01	2.277E+00	6.108E+00	1.580E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 3.509 FOR BA-134 AND 5.285 FOR BA-135.

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MAT number = 5640

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 56-BA-135 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-SEP90 REV2-NOV93
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.
93-11 JENDL-3.2 WAS MADE BY JNDC FPND W.G.

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)       RESOLVED RESONANCE PARAMETERS.  NEGATIVE
                    RESONANCE PARAMETERS WERE SLIGHTLY MODIFIED.
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MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 5.96 KEV THE
       EVALUATION FOR JENDL-2 WAS MADE BY KIKUCHI/3/.  FOR THE
    RESONANCES BELOW 1.4 KEV, NEUTRON WIDTHS WERE OBTAINED FROM
    THE EXPERIMENTAL DATA OF ALVES ET AL./4/ AND VAN DE VYVER AND
    PATTENDEN/5/.  RADIATION WIDTHS WERE BASED ON THE DATA OF
    ALVES ET AL. OR AVERAGE VALUE OF 0.15 EV BY MUSGROVE ET AL./6/
    ABOVE 3 KEV, PARAMETERS WERE DETERMINED FROM THE DATA OF
    MUSGROVE ET AL.  IN THE ENERGY RANGE BELOW 3 KEV, MANY
    ARTIFICIAL LEVELS WERE GENERATED WITH STAT/7/ BY ASSUMING
    D=39.3 EV, S0=0.8E-4, S1=0.48E-4 AND AVERAGE RADIATION WIDTH
    OF 0.15 EV.  A NEGATIVE RESONANCE WAS ADDED SO AS TO REPRODUCE
    THE CAPTURE CROSS SECTION OF 5.8+-0.9 BARNS AT 0.0253 EV/8/.
       FOR JENDL-3, THE JENDL-2 DATA WERE MODIFIED ON THE BASIS OF
    THE LATEST EXPERIMENTAL DATA OF MIZUMOTO/9/.  RESONANCE
    ENERGIES AND NEUTRON WIDTHS OF JENDL-2 WERE PARTIALLY MODIFIED
    WITH MIZUMOTO'S DATA IN THE ENERGY RANGE FORM 404.5 EV TO 4.95
    KEV. TOTAL SPIN J OF SOME RESONANCES WAS TENTATIVELY ESTIMATED
    WITH A RANDOM NUMBER METHOD.  THE PARAMETERS OF NEGATIVE LEVEL
    WERE ADJUSTED TO THE CAPTURE CROSS SECTION RECOMMENDED BY
    MUGHABGHAB ET AL./8/
       FOR JENDL-3.2, A SLIGHT MODIFICATION OF THE NEGATIVE LEVEL
    WAS MADE.

  UNRESOLVED RESONANCE REGION : 5.96 KEV - 100 KEV
    PARAMETERS WERE ADJUSTED TO REPRODUCE THE CAPTURE CROSS
    SECTION CALCULATED WITH CASTHY/10/ (JENDL-2 VALUE) BELOW 40
    KEV, AND THE CAPTURE CROSS SECTION MEASURED BY MUSGROVE ET
    AL./11/ ABOVE 40 KEV.  THE INITIAL VALUES OF NEUTRON STRENGTH
    FUNCTIONS, S0 AND S1, WERE ADOPTED FROM THE RECOMMENDATION BY
    MUGHABGHAB ET AL., AND S2 WAS TAKEN FROM CALCULATION WITH
    CASTHY/10/.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED FROM
    FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.  THE
    RADIATION WIDTH GG WAS BASED ON THE COMPILATION OF OF
    MUGHABGHAB ET AL.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.922E-4, S1 = 0.491E-4, S2 = 0.584E-4, SG = 70.2E-4,
    GG = 0.150 EV, R  = 5.232 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           7.594                   -
      ELASTIC         1.798                   -
      CAPTURE         5.796                  131

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/12/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING WS AND RSO OF IIJIMA-KAWAI POTENTIAL/13/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/14/
     ALPHA    = HUIZENGA AND IGO/15/
     DEUTERON = LOHR AND HAEBERLI/16/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/17/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/18/ WERE EVALUATED BY IIJIMA ET AL./19/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
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   IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
   PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
   /20/.

   MT = 1  TOTAL
     SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

   MT = 2  ELASTIC SCATTERING
     CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

   MT = 4, 51 - 91  INELASTIC SCATTERING
     SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
     ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./21/.

            NO.      ENERGY(MEV)    SPIN-PARITY
            GR.       0.0             3/2 +
             1        0.2210          1/2 +
             2        0.2682         11/2 -
             3        0.4806          5/2 +
             4        0.5879          3/2 +
             5        0.8550          3/2 +
             6        0.8745          7/2 +
             7        0.9800          3/2 +
       LEVELS ABOVE 1.17 MEV WERE ASSUMED TO BE OVERLAPPING.

   MT = 102  CAPTURE
     SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
     CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
     SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
     AND REFFO/22/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

     THE GAMMA-RAY STRENGTH FUNCTION (5.93E-03) WAS ADJUSTED TO
     REPRODUCE THE CAPTURE CROSS SECTION OF 250 MILLI-BARNS AT 100
     KEV MEASURED BY MUSGROVE ET AL./11/

   MT = 16  (N,2N) CROSS SECTION
   MT = 17  (N,3N) CROSS SECTION
   MT = 22  (N,N'A) CROSS SECTION
   MT = 28  (N,N'P) CROSS SECTION
   MT = 32  (N,N'D) CROSS SECTION
   MT =103  (N,P) CROSS SECTION
   MT =104  (N,D) CROSS SECTION
   MT =105  (N,T) CROSS SECTION
   MT =106  (N,HE3) CROSS SECTION
   MT =107  (N,ALPHA) CROSS SECTION
     THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
     PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

     THE KALBACH'S CONSTANT K (= 268.3) WAS ESTIMATED BY THE
     FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/23/ AND LEVEL
     DENSITY PARAMETERS.

     FINALLY, THE (N,2N), (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
     NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
       (N,2N)      1630.00  MB (SYSTEMATICS OF WEN DEN LU+/24/)
       (N,P)          5.88  MB (SYSTEMATICS OF FORREST/25/)
       (N,ALPHA)      2.64  MB (SYSTEMATICS OF FORREST)

   MT = 251  MU-BAR
     CALCULATED WITH CASTHY.

 MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
   LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
   GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
   TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
   CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
   BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

 MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
   ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
   PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
   OTHER NEUTRON EMITTING REACTIONS.

 TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
          ----------------------   ------------  ---------------
        V  = 41.8                 R0 = 6.89     A0 = 0.62
        WS = 2.95+0.789E          RS = 7.098    AS = 0.35
        VSO= 7.0                  RSO= 6.89     ASO= 0.62
   THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.
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TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
54-XE-131		1.740E+01	6.000E-01	3.176E+00	5.394E+00	1.120E+00
54-XE-132		1.563E+01	6.500E-01	5.485E-01	6.600E+00	2.160E+00
54-XE-133		1.600E+01	6.250E-01	2.327E+00	5.284E+00	1.120E+00
54-XE-134		1.400E+01	6.300E-01	3.184E-01	5.224E+00	1.820E+00
55-CS-132	*	1.676E+01	5.726E-01	1.123E+01	3.569E+00	0.0
55-CS-133		1.750E+01	6.000E-01	3.784E+00	5.352E+00	1.040E+00
55-CS-134		1.598E+01	6.450E-01	1.710E+01	4.505E+00	0.0
55-CS-135		1.343E+01	6.537E-01	1.831E+00	4.203E+00	7.000E-01
56-BA-133		1.941E+01	5.930E-01	3.357E+00	6.465E+00	1.580E+00
56-BA-134		1.800E+01	6.100E-01	4.177E-01	7.309E+00	2.620E+00
56-BA-135		1.902E+01	5.820E-01	2.277E+00	6.108E+00	1.580E+00
56-BA-136		1.610E+01	6.500E-01	5.721E-01	6.928E+00	2.280E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 5.285 FOR BA-135 AND 6.925 FOR BA-136.

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MAT number = 5643

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 56-BA-136 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE PARAMETERS FOR MLBW FORMULA (BELOW 34.49 KEV)
    THE PARAMETERS ARE THE SAME AS JENDL-2 EVALUATED BY KIKUCHI ET
    AL./3/ ON THE BASIS OF EXPERIMENTAL DATA OF ALVES ET AL./4/,
    VAN DE VYVER AND PATTENDEN/5/ AND MUSGROVE ET AL./6/  THE
    AVERAGE RADIATION WIDTH OF 0.125 EV/7/ WAS ASSUMED.  BELOW 3
    KEV, 6 ARTIFICIAL LEVELS WERE GENERATED WITH STAT/8/ BY
    ASSUMING D = 225 EV, S0 = 0.8E-4/7/, S1 = 0.8E-4 AND THE
    RADIATION WIDTH OF 0.125 EV.  A NEGATIVE RESONANCE WAS ADDED
    BY REFERRING TO REF./7/ IN ORDER TO REPRODUCE THE CAPTURE
    CROSS SECTION OF 0.4 BARNS AT 0.0253 EV/7/.

  UNRESOLVED RESONANCE REGION : 34.49 KEV - 100 KEV
    UNRESOLVED RESONANCE PARAMETERS WERE ADOPTED FROM JENDL-2.
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/9/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.520E-4, S1 = 0.850E-4, S2 = 0.550E-4, SG = 1.32E-4,
    GG = 0.112 EV, R  = 5.288 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S                RES. INTEG.
      TOTAL           2.965                     -
      ELASTIC         2.564                     -
      CAPTURE         0.4001                     2.06

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/10/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING WS AND RSO OF IIJIMA-KAWAI POTENTIAL/11/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/12/
     ALPHA    = HUIZENGA AND IGO/13/
     DEUTERON = LOHR AND HAEBERLI/14/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/15/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/16/ WERE EVALUATED BY IIJIMA ET AL./17/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /18/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./19/.

           NO.      ENERGY(MEV)    SPIN-PARITY   DWBA CAL.
           GR.       0.0             0  +
            1        0.8186          2  +            *
            2        1.5505          2  +
            3        1.5792          0  +
            4        1.8663          4  +
            5        2.0540          4  +
            6        2.0799          2  +
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           7        2.1280          2  +
           8        2.1402          5  -
           9        2.1415          0  +
          10        2.2071          6  +
      LEVELS ABOVE 2.284 MEV WERE ASSUMED TO BE OVERLAPPING.

    FOR THE LEVELS WITH AN ASTERISK, THE CONTRIBUTION OF DIRECT
    INELASTIC SCATTERING CROSS SECTIONS WAS CALCULATED BY THE
    DWUCK-4 CODE/20/.  DEFORMATION PARAMETER (BETA2 = 0.1242) WAS
    BASED ON THE DATA COMPILED BY RAMAN ET AL./21/

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/22/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (1.22E-04) WAS ADJUSTED TO
    REPRODUCE THE CAPTURE CROSS SECTION OF 45 MILLI-BARNS AT 70
    KEV MEASURED BY MUSGROVE ET AL./23/

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (= 257.1) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/24/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,2N), (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,2N)      1670.00  MB (SYSTEMATICS OF WEN DEN LU+/25/)
      (N,P)          6.00  MB (MEASURED BY IKEDA+/26/)
      (N,ALPHA)      2.04  MB (SYSTEMATICS OF FORREST/27/)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  CONTRIBUTION OF DIRECT INELASTIC
  SCATTERING WAS CALCULATED WITH DWUCK-4.  FOR OTHER REACTIONS,
  ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING FROM OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
         ----------------------   ------------  ---------------
         V  = 41.8                R0 = 6.89     A0 = 0.62
         WS = 2.95+0.789E         RS = 7.098    AS = 0.35
         VSO= 7.0                 RSO= 6.89     ASO= 0.62
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2  LEVEL DENSITY PARAMETERS

 NUCLIDE       A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
 ---------------------------------------------------------------
 54-XE-132     1.563E+01 6.500E-01 5.485E-01 6.600E+00 2.160E+00
 54-XE-133     1.600E+01 6.250E-01 2.327E+00 5.284E+00 1.120E+00
 54-XE-134     1.400E+01 6.300E-01 3.184E-01 5.224E+00 1.820E+00
 54-XE-135     1.550E+01 5.565E-01 7.506E-01 4.010E+00 1.120E+00

 55-CS-133     1.750E+01 6.000E-01 3.784E+00 5.352E+00 1.040E+00
 55-CS-134     1.598E+01 6.450E-01 1.710E+01 4.505E+00 0.0
 55-CS-135     1.343E+01 6.537E-01 1.831E+00 4.203E+00 7.000E-01
 55-CS-136     1.400E+01 6.000E-01 4.424E+00 2.967E+00 0.0

 56-BA-134     1.800E+01 6.100E-01 4.177E-01 7.309E+00 2.620E+00
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56-BA-135	1.902E+01	5.820E-01	2.277E+00	6.108E+00	1.580E+00
56-BA-136	1.610E+01	6.500E-01	5.721E-01	6.928E+00	2.280E+00
56-BA-137	1.645E+01	5.640E-01	5.394E-01	4.905E+00	1.580E+00

SPIN CUTOFF PARAMS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 6.925 FOR BA-136 AND 5.625 FOR BA-137.

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MAT number = 5646
 56-BA-137 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-SEP90 REV2-OCT93
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.
93-10 JENDL-3.2 WAS MADE BY JNDC FPND W.G.

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)       RESOLVED RESONANCE PARAMETERS WERE MODIFIED.
     ***********************************************************


MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 11.885 KEV
       FOR JENDL-2, EVALUATION WAS MADE BY KIKUCHI/3/.  BELOW 1.7
    KEV, PARAMETERS WERE DETERMINED FROM THE EXPERIMENTAL DATA OF
    ALVES ET AL./4/ AND VAN DE VYVER AND PATTENDEN/5/.  AVERAGE
    RADIATION WIDTHS WERE ASSUMED TO BE 0.08 EV FOR S-WAVE
    RESONANCES AND 0.068 EV FOR P-WAVE ONES EXCEPT FOR 420- AND
    578-EV LEVELS.  ABOVE 3 KEV, EVALUATION WAS BASED ON THE DATA
    OF MUSGROVE ET AL./6/.  MANY ARTIFICIAL LEVELS WERE GENERATED
    WITH STAT/7/ BY ASSUMING D=380 EV, S0=0.57E-4, S1=0.45E-4.  A
    NEGATIVE RESONANCE WAS ADDED AT -26 EV SO AS TO REPRODUCE THE
    CAPTURE CROSS SECTION OF 5.1 +- 0.4 BARNS AT 0.0253 EV/8/.
       FOR JENDL-3, THE RESONANCE PARAMETERS OF JENDL-2 WERE
    UPDATED BY USING THE NEWEST EXPERIMENTAL DATA BY MIZUMOTO /9/.
    THE RESONANCE ENERGIES AND NEUTRON WIDTHS WERE REPLACED BY
    MIZUMOTO'S DATA IN THE ENERGY RANGE FROM 418.3 EV TO 14.941
    KEV.  AVERAGE RADIATION WIDTH AND SCATTERING RADIUS WERE TAKEN
    FROM MUGHABGHAB ET AL./8/ TOTAL SPIN J OF SOME RESONANCES WAS
    TENTATIVELY ESTIMATED WITH A RANDOM NUMBER METHOD.

  UNRESOLVED RESONANCE REGION : 11.885 KEV - 100 KEV
    INITIAL VALUES OF NEUTRON STRENGTH FUNCTIONS, S0 AND S1, WERE
    ADOPTED FROM THE RECOMMENDATION BY MUGHABGHAB ET AL., AND S2
    WAS TAKEN FROM CALCULATION WITH CASTHY/10/.  THE PARAMETERS
    WERE ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION MEASURED
    BY MUSGROVE ET AL./11/  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.  THE RADIATION WIDTH GG WAS ADOPTED FROM REF./8/.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.695E-4, S1 = 0.525E-4, S2 = 0.949E-4, SG = 3.91E-4,
    GG = 0.080 EV, R  = 5.729 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           9.0034                  -
      ELASTIC         3.8816                  -
      CAPTURE         5.1218                   4.75

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/12/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING WS AND RSO OF IIJIMA-KAWAI POTENTIAL/13/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/14/
     ALPHA    = HUIZENGA AND IGO/15/
     DEUTERON = LOHR AND HAEBERLI/16/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/17/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/18/ WERE EVALUATED BY IIJIMA ET AL./19/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /20/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
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CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

MT = 4, 51 - 91 INELASTIC SCATTERING
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS ADOPTED. THE LEVEL SCHEME WAS TAKEN FROM REF./21/.

NO.	ENERGY(MEV)	SPIN-PARITY
GR.	0.0	3/2 +
1	0.2792	1/2 +
2	0.6616	11/2 -
3	1.2900	5/2 +
4	1.4629	5/2 +
5	1.7900	7/2 -
6	1.8400	1/2 +
7	1.9000	5/2 +
8	2.0400	5/2 +

LEVELS ABOVE 2.12 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/22/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (3.65E-04) WAS ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION OF 33 MILLI-BARNS AT 100 KEV MEASURED BY MUSGROVE ET AL./11/

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT = 32 (N,N'D) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 435.5) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/23/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,2N), (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,2N)	1710.00	MB	(SYSTEMATICS OF WEN DEN LU+/24/)
(N,P)	3.32	MB	(SYSTEMATICS OF FORREST/25/)
(N,ALPHA)	1.59	MB	(SYSTEMATICS OF FORREST)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING FROM OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 41.8	R0 = 6.89	A0 = 0.62
WS = 2.95+0.789E	RS = 7.098	AS = 0.35
VSO= 7.0	RSO= 6.89	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
54-XE-133	1.600E+01	6.250E-01	2.327E+00	5.284E+00	1.120E+00
54-XE-134	1.400E+01	6.300E-01	3.184E-01	5.224E+00	1.820E+00
54-XE-135	1.550E+01	5.565E-01	7.506E-01	4.010E+00	1.120E+00
54-XE-136	1.400E+01	6.500E-01	3.270E-01	5.679E+00	1.970E+00

55-CS-134	1.598E+01	6.450E-01	1.710E+01	4.505E+00	0.0
55-CS-135	1.343E+01	6.537E-01	1.831E+00	4.203E+00	7.000E-01
55-CS-136	1.400E+01	6.000E-01	4.424E+00	2.967E+00	0.0
55-CS-137	1.336E+01	6.200E-01	9.986E-01	3.836E+00	8.500E-01
56-BA-135	1.902E+01	5.820E-01	2.277E+00	6.108E+00	1.580E+00
56-BA-136	1.610E+01	6.500E-01	5.721E-01	6.928E+00	2.280E+00
56-BA-137	1.645E+01	5.640E-01	5.394E-01	4.905E+00	1.580E+00
56-BA-138	1.390E+01	7.200E-01	4.123E-01	7.233E+00	2.430E+00

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 5.625 FOR BA-137 AND 7.914 FOR BA-138.

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MAT number = 5649
 56-BA-138 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-SEP90 REV2-OCT93
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.
93-10 JENDL-3.2 WAS MADE BY JNDC FPND W.G.

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)       RESOLVED RESONANCE PARAMETERS
      (3,102)       RE-NORMALIZATION
      (3,2), (3,4), (3,51-91) AND ANGULAR DISTRIBUTIONS
                    SMALL EFFECTS OF THE RE-NORMALIZATION OF
                    CAPTURE CROSS SECTION. ( < 0.3% )
     ***********************************************************


MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE PARAMETERS FOR MLBW FORMULA (BELOW 100 KEV)
       FOR JENDL-2, EVALUATION WAS MADE BY KIKUCHI /3/ MAINLY ON
    THE BASIS OF THE DATA MEASURED BY MUSGROVE ET AL./4/ UP TO 92
    KEV.  ABOVE 100 KEV, NEUTRON WIDTHS WERE ADOPTED FROM BILPUCH
    ET AL./5/  AVERAGE CAPTURE WIDTHS WERE ASSUMED TO BE 0.055+-
    0.020 EV FOR S-WAVE RESONANCES AND 0.045+-0.020 EV FOR P-WAVE
    ONES, AND TO BE 0.095 EV IN THE ENERGY RANGE ABOVE 100 KEV.  A
    NEGATIVE RESONANCE WAS ADDED AT -6.22 KEV SO AS TO REPRODUCE
    THE CAPTURE CROSS SECTION OF 0.360+-0.036 BARNS AT 0.0253
    EV/6/.
      FOR JENDL-3, 10 RESONANCES WERE NEWLY ASIGNED BY TAKING THE
    EXPERIMENTAL DATA BY MIZUMOTO/7/ IN THE ENERGY RANGE FROM 648
    EV TO 63.12 KEV.  TOTAL SPIN J OF SOME RESONANCES WAS TENTA-
    TIVELY ESTIMATED WITH A RANDOM NUMBER METHOD

  NO UNRESOLVED RESONANCE REGION

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL          5.9090                    -
      ELASTIC        5.5499                    -
      CAPTURE        0.3591                     0.265

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY/8/, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/9/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE BA-NAT. TOTAL
  CROSS SECTION BY CHANGING WS AND RSO OF IIJIMA-KAWAI POTENTIAL
  /10/.  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/11/
     ALPHA    = HUIZENGA AND IGO/12/
     DEUTERON = LOHR AND HAEBERLI/13/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/14/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/15/ WERE EVALUATED BY IIJIMA ET AL./16/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /17/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./18/.

           NO.      ENERGY(MEV)    SPIN-PARITY    DWBA CAL.
           GR.       0.0             0  +
            1        1.4359          2  +            *
            2        1.8987          4  +
            3        2.0907          6  +
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4	2.1896	2	+	
5	2.2032	6	+	
6	2.2180	2	+	
7	2.3077	4	+	
8	2.4156	5	+	
9	2.4457	3	+	
10	2.5832	1	+	
11	2.5840	4	+	
12	2.6396	2	+	
13	2.7795	4	+	
14	2.8517	3	+	
15	2.8810	3	-	*
16	2.9315	1	+	
17	2.9912	3	+	
18	3.0500	2	+	
19	3.1560	4	+	

LEVELS ABOVE 3.164 MEV WERE ASSUMED TO BE OVERLAPPING.

FOR THE LEVELS WITH AN ASTERISK, THE CONTRIBUTION OF DIRECT INELASTIC SCATTERING CROSS SECTIONS WAS CALCULATED BY THE DWUCK-4 CODE/19/. DEFORMATION PARAMETERS (BETA2 = 0.0925 AND BETA3 = 0.118) WERE BASED ON THE DATA COMPILED BY RAMAN ET AL./20/ AND SPEAR/21/, RESPECTIVELY.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/22/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (2.54E-06) WAS ADJUSTED TO THE CAPTURE CROSS SECTION OF 2.7 MILLI-BARNS AT 700 KEV SO AS TO REPRODUCE THE CROSS SECTION MEASURED BY JOHNSRUD ET AL./23/ AND STAVISSKIJ AND TOLSTIKOV/24/

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 144.6) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/25/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,2N), (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,2N)	1750.00	MB	(SYSTEMATICS OF WEN DEN LU+/26/)
(N,P)	2.80	MB	(MEASURED BY IKEDA+/27/)
(N,ALPHA)	2.10	MB	(MEASURED BY IKEDA+)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. CONTRIBUTION OF DIRECT INELASTIC SCATTERING WAS CALCULATED WITH DWUCK-4. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 41.8	R0 = 6.89	A0 = 0.62
WS = 2.95+0.789E	RS = 7.098	AS = 0.35
VSO= 7.0	RSO= 6.89	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
54-XE-134	1.400E+01	6.300E-01	3.184E-01	5.224E+00	1.820E+00
54-XE-135	1.550E+01	5.565E-01	7.506E-01	4.010E+00	1.120E+00
54-XE-136	1.400E+01	6.500E-01	3.270E-01	5.679E+00	1.970E+00
54-XE-137	1.550E+01	5.565E-01	7.470E-01	4.010E+00	1.120E+00
55-CS-135	1.343E+01	6.537E-01	1.831E+00	4.203E+00	7.000E-01
55-CS-136	1.400E+01	6.000E-01	4.424E+00	2.967E+00	0.0
55-CS-137	1.336E+01	6.200E-01	9.986E-01	3.836E+00	8.500E-01
55-CS-138	1.470E+01	5.737E-01	4.715E+00	2.858E+00	0.0
56-BA-136	1.610E+01	6.500E-01	5.721E-01	6.928E+00	2.280E+00
56-BA-137	1.645E+01	5.640E-01	5.394E-01	4.905E+00	1.580E+00
56-BA-138	1.390E+01	7.200E-01	4.123E-01	7.233E+00	2.430E+00
56-BA-139	2.022E+01	4.800E-01	5.326E-01	4.629E+00	1.580E+00

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 7.914 FOR BA-138 AND 5.0 FOR BA-139.

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MAT number = 5655

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 56-BA-140 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  NO RESOLVED RESONANCE PARAMETERS

  UNRESOLVED RESONANCE REGION : 14 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/2/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.  THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS
    OF MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.520E-4, S1 = 0.840E-4, S2 = 0.550E-4, SG = 0.0303E-4,
    GG = 0.075 EV, R  = 5.301 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S                RES. INTEG.
      TOTAL           4.900                    -
      ELASTIC         3.300                    -
      CAPTURE         1.600                     0.728

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 14 KEV, THE CAPTURE AND ELASTIC SCATTERING CROSS SECTIONS
  WERE ASSUMED TO BE IN 1/V FORM AND CONSTANT, RESPECTIVELY.  THE
  CAPTURE CROSS SECTION AT 0.0253 EV WAS TAKEN FROM REF./3/, AND
  THE ELASTIC SCATTERING CROSS SECTION WAS ESTIMATED BY ASSUMING
  R = 5.2 FM.  UNRESOLVED RESONANCE PARAMETERS WERE GIVEN IN THE
  ENERGY RANGE FROM 14 KEV TO 100 KEV.

  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/4/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE BA-NATURAL
  TOTAL CROSS SECTION BY CHANGING WS AND RSO OF IIJIMA-KAWAI
  POTENTIAL/5/.  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/6/
     ALPHA    = HUIZENGA AND IGO/7/
     DEUTERON = LOHR AND HAEBERLI/8/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/9/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/10/ WERE EVALUATED BY IIJIMA ET AL./11/   MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /12/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/13/ AND NUCLEAR DATA
    SHEETS/14/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             0  +
            1        0.6023          2  +
            2        1.1306          4  +
            3        1.5107          2  +
            4        1.8027          3  -
            5        1.8240          0  +
            6        1.9513          3  +
            7        1.9937          2  +
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LEVELS ABOVE 2.061 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/15/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (2.71E-06) WAS ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION OF 3.2 MILLI-BARNS AT 70 KEV MEASURED BY MUSGROVE ET AL./16/ FOR BA-138. (THE SAME CROSS SECTION AS BA-138 WAS ASSUMED.)

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT = 32 (N,N'D) CROSS SECTION
MT = 33 (N,N'T) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 304.6) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/17/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,P)	1.40 MB	(SYSTEMATICS OF FORREST/18/)
(N,ALPHA)	0.76 MB	(SYSTEMATICS OF FORREST)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 41.8	R0 = 6.89	A0 = 0.62
WS = 2.95+0.789E	RS = 7.098	AS = 0.35
VSO= 7.0	RSO= 6.89	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
54-XE-136		1.400E+01	6.500E-01	3.270E-01	5.679E+00	1.970E+00
54-XE-137		1.550E+01	5.565E-01	7.470E-01	4.010E+00	1.120E+00
54-XE-138	*	1.684E+01	5.580E-01	3.365E-01	5.240E+00	1.880E+00
54-XE-139	*	1.849E+01	5.556E-01	2.542E+00	4.980E+00	1.120E+00
55-CS-137		1.336E+01	6.200E-01	9.986E-01	3.836E+00	8.500E-01
55-CS-138		1.470E+01	5.737E-01	4.715E+00	2.858E+00	0.0
55-CS-139	*	1.696E+01	5.556E-01	2.545E+00	4.122E+00	7.600E-01
55-CS-140		1.484E+01	6.545E-01	1.053E+01	4.162E+00	0.0
56-BA-138		1.390E+01	7.200E-01	4.123E-01	7.233E+00	2.430E+00
56-BA-139		2.022E+01	4.800E-01	5.326E-01	4.629E+00	1.580E+00
56-BA-140		1.500E+01	6.930E-01	5.738E-01	7.244E+00	2.340E+00
56-BA-141		1.600E+01	7.010E-01	3.318E+00	7.141E+00	1.580E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE

ASSUMED TO BE 4.553 FOR BA-140 AND 5.0 FOR BA-141.

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MAT number = 5725

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 57-LA-138 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 0.33 KEV
    RESONANCE PARAMETERS WERE BASED ON MUGHABGHAB ET AL./2/ TOTAL
    SPIN J OF SOME RESONANCES WAS EVALUATED BY MEANS OF A RANDOM
    NUMBER METHOD.  NEUTRON ORBITAL ANGULAR MOMENTUM L WAS
    ESTIMATED WITH A METHOD OF BOLLINGER AND THOMAS/3/, AND
    FINALLY ALL RESONANCES WERE ASSIGNED TO S-WAVE ONES.  AVERAGE
    RADIATION WIDTH WAS TAKEN FROM MUGHABGHAB ET AL.  A NEGATIVE
    RESONANCE WAS ADDED SO AS TO REPRODUCE THE THERMAL CAPTURE
    CROSS SECTION GIVEN BY MUGHABGHAB ET AL.

  UNRESOLVED RESONANCE REGION : 0.330 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/4/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.  THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS
    OF MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.440E-4, S1 = 0.960E-4, S2 = 0.480E-4, SG = 35.2E-4,
    GG = 0.085 EV, R  = 5.480 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL          70.06                     -
      ELASTIC        12.98                     -
      CAPTURE        57.08                   365

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/5/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED SO AS TO REPRODUCE THE LA-139 TOTAL CROSS SECTIONS
  MEASURED BY FOSTER AND GLASGOW./6/, ISLAM ET AL./7/, NISHIMURA
  ET AL./8/ AND SO ON.  THE OMP'S FOR CHARGED PARTICLES ARE AS
  FOLLOWS:
     PROTON   = PEREY/9/
     ALPHA    = HUIZENGA AND IGO/10/
     DEUTERON = LOHR AND HAEBERLI/11/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/12/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/13/ WERE EVALUATED BY IIJIMA ET AL./14/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /15/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/16/ AND NUCLEAR DATA
    SHEETS/17/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             5  +
            1        0.0726          3  +
            2        0.1162          2  +
            3        0.1612          3  +
            4        0.1922          2  +
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5	0.2304	4	+
6	0.2930	1	+
7	0.4133	3	+
8	0.4793	4	+
9	0.5105	3	+
10	0.5187	4	+
11	0.6423	2	+
12	0.7377	2	-
13	0.7387	4	-
14	0.8234	3	-
15	0.8360	7	-

LEVELS ABOVE 0.843 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/18/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (3.5E-03) WAS DETERMINED FROM THE SYSTEMATICS OF RADIATION WIDTH (0.085 EV) AND THE AVERAGE S-WAVE RESONANCE LEVEL SPACING (24.5 EV) CALCULATED FROM THE LEVEL DENSITY PARAMETERS.

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT = 32 (N,N'D) CROSS SECTION
MT = 33 (N,N'T) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =106 (N,HE3) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 454.8) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/19/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
(N,P) 5.16 MB (SYSTEMATICS OF FORREST/20/)
(N,ALPHA) 2.29 MB (SYSTEMATICS OF FORREST)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 41.8	R0 = 6.858	A0 = 0.62
WS = 2.95+0.789E	RS = 7.064	AS = 0.35
VSO= 7.0	RSO= 6.858	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
55-CS-134		1.598E+01	6.450E-01	1.710E+01	4.505E+00	0.0
55-CS-135		1.343E+01	6.537E-01	1.831E+00	4.203E+00	7.000E-01
55-CS-136		1.400E+01	6.000E-01	4.424E+00	2.967E+00	0.0
55-CS-137		1.336E+01	6.200E-01	9.986E-01	3.836E+00	8.500E-01
56-BA-135		1.902E+01	5.820E-01	2.277E+00	6.108E+00	1.580E+00
56-BA-136		1.610E+01	6.500E-01	5.721E-01	6.928E+00	2.280E+00

56-BA-137		1.645E+01	5.640E-01	5.394E-01	4.905E+00	1.580E+00
56-BA-138		1.390E+01	7.200E-01	4.123E-01	7.233E+00	2.430E+00
57-LA-136	*	1.638E+01	5.629E-01	8.565E+00	3.286E+00	0.0
57-LA-137		1.558E+01	6.210E-01	3.521E+00	4.624E+00	7.000E-01
57-LA-138		1.450E+01	6.310E-01	7.202E+00	3.634E+00	0.0
57-LA-139		1.380E+01	6.500E-01	1.653E+00	4.468E+00	8.500E-01

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 7.524 FOR LA-138 AND 7.875 FOR LA-139.

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MAT number = 5728

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 57-LA-139 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-SEP90 REV2-NOV93
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.
93-11 JENDL-3.2 WAS MADE BY JNDC FPND W.G.

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)        RESOLVED RESONANCE PARAMETERS
     ***********************************************************


MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 15.0 KEV
      RESONANCE PARAMETERS OF JENDL-2/3/ WERE MODIFIED ON THE
    BASIS OF THE EXPERIMENTAL DATA OF NAKAJIMA/4/ AT 72.3 EV, AND
    IN THE ENERGY RANGE FROM 617.2 TO 2464 EV WHERE 20 RESONANCES
    WERE GIVEN.  RESONANCE ENERGIES WERE MAINLY BASED ON THE DATA
    OF JENDL-2 AND SUPPLEMENTED WITH THE EXPERIMENTAL DATA OF
    NAKAJIMA.  NEUTRON WIDTHS WERE DERIVED FROM THE NEUTRON
    CAPTURE AREA DATA BY USING THE AVERAGE RADIATION WIDTH OF
    0.050 EV/3/.
      TOTAL SPIN J OF SOME RESONANCES WAS TENTATIVELY ESTIMATED
    WITH A RANDOM NUMBER METHOD.  ASSIGNMENT OF NEUTRON ORBITAL
    ANGULAR MOMENTUM L IS THE SAME AS THE JENDL-2 EVALUATION.
      TWO NEGATIVE RESONANCES WERE ADDED SO AS TO REPRODUCE THE
    THERMAL CAPTURE AND SCATTERING CROSS SECTIONS GIVEN BY
    MUGHABGHAB ET AL.
      FOR JENDL-3.2, THESE RESONANCE PARAMETERS WERE MODIFIED SO
    AS TO REPRODUCE THE AREA DATA MEASURED AT ORNL, BY TAKING
    ACCOUNT OF THE CORRECTION FACTOR OF 1.0737 ANNOUNCED BY ALLEN
    ET AL./5/.  THE UUPER BOUNDARY WAS CHANGED FROM 25.9 KEV TO
    15 KEV.

  UNRESOLVED RESONANCE REGION : 15 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTION S0 AND S1 WERE BASED ON THE
    COMPILATION OF MUGHABGHAB ET AL., AND S2 WAS CALCULATED WITH
    OPTICAL MODEL CODE CASTHY/6/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH GG WAS BASED ON THE COMPILATION OF
    MUGHABGHAB ET AL.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.780E-4, S1 = 0.400E-4, S2 = 0.500E-4, SG = 2.04E-4,
    GG = 0.055 EV, R  = 5.455 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S                RES. INTEG.
      TOTAL          19.060                    -
      ELASTIC        10.130                    -
      CAPTURE         8.930                  11.8

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/7/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED SO AS TO REPRODUCE THE LA-139 TOTAL CROSS SECTIONS
  MEASURED BY FOSTER AND GLASGOW/8/, ISLAM ET AL./9/, NISHIMURA ET
  AL./10/ AND SO ON.  THE OMP'S FOR CHARGED PARTICLES ARE AS
  FOLLOWS:
     PROTON   = PEREY/11/
     ALPHA    = HUIZENGA AND IGO/12/
     DEUTERON = LOHR AND HAEBERLI/13/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/14/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/15/ WERE EVALUATED BY IIJIMA ET AL./16/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /17/.
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  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./18/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             7/2 +
            1        0.1658          5/2 +
            2        1.2060          1/2 +
            3        1.2191          9/2 +
            4        1.2566          5/2 +
            5        1.3813          7/2 +
            6        1.4205          7/2 +
            7        1.4390         11/2 -
            8        1.4764          7/2 +
            9        1.5363          7/2 +
           10        1.5582          3/2 +
           11        1.5782          9/2 +
           12        1.6831          7/2 +
      LEVELS ABOVE 1.75 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/19/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (2.06E-04) WAS ADJUSTED TO
    REPRODUCE THE CAPTURE CROSS SECTION OF 38 MILLI-BARNS AT 30
    KEV MEASURED BY MUSGROVE ET AL./20/

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT = 32  (N,N'D) CROSS SECTION
  MT = 33  (N,N'T) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =106  (N,HE3) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (= 322.9) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/21/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,P)           5.00  MB (RECOMMENDED BY FORREST/22/)
      (N,ALPHA)       2.50  MB (MEASURED BY WOELFLE+/23/)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY/6/.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING FROM OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
         ----------------------   ------------  ---------------
        V  = 41.8                 R0 = 6.874    A0 = 0.62
        WS = 2.95+0.789E          RS = 7.081    AS = 0.35
        VSO= 7.0                  RSO= 6.874    ASO= 0.62
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.
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TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
55-CS-135	1.343E+01	6.537E-01	1.831E+00	4.203E+00	7.000E-01
55-CS-136	1.400E+01	6.000E-01	4.424E+00	2.967E+00	0.0
55-CS-137	1.336E+01	6.200E-01	9.986E-01	3.836E+00	8.500E-01
55-CS-138	1.470E+01	5.737E-01	4.715E+00	2.858E+00	0.0
56-BA-136	1.610E+01	6.500E-01	5.721E-01	6.928E+00	2.280E+00
56-BA-137	1.645E+01	5.640E-01	5.394E-01	4.905E+00	1.580E+00
56-BA-138	1.390E+01	7.200E-01	4.123E-01	7.233E+00	2.430E+00
56-BA-139	2.022E+01	4.800E-01	5.326E-01	4.629E+00	1.580E+00
57-LA-137	1.558E+01	6.210E-01	3.521E+00	4.624E+00	7.000E-01
57-LA-138	1.450E+01	6.310E-01	7.202E+00	3.634E+00	0.0
57-LA-139	1.380E+01	6.500E-01	1.653E+00	4.468E+00	8.500E-01
57-LA-140	1.558E+01	5.900E-01	7.912E+00	3.425E+00	0.0

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 7.875 FOR LA-139 AND 5.0 FOR LA-140.

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MAT number = 5837

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 58-CE-140 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-SEP90 REV2-NOV93
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.
93-10 JENDL-3.2 WAS MADE BY JNDC FPND W.G.

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)       RESOLVED RESONANCE PARAMETERS
     ***********************************************************


MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 200 KEV
      RESONANCE PARAMETERS EVALUATED BY KIKUCHI/3/ FOR JENDL-2
    WERE ADOPTED.  NEUTRON WIDTHS WERE OBTAINED FROM DATA MEASURED
    BY HACKEN ET AL./4/ AND CAMARDA /5/, AND RADIATION WIDTHS FROM
    CAPTURE AREAS BY MUSGROVE ET AL./6/ FOR THE RESONANCES ONLY
    WHOSE CAPTURE AREA WAS MEASURED. THE NEUTRON WIDTH WAS DEDUCED
    BY ASSUMING THE AVERAGE RADIATION WIDTH OF 0.034+-0.029 EV FOR
    S-WAVE RESONANCES AND 0.029+-0.008 EV FOR P-WAVE ONES.  A
    NEGATIVE RESONANCE WAS ADDED SO AS TO REPRODUCE THE CAPTURE
    CROSS SECTION OF 0.57+-0.04 BARN AND THE ELASTIC SCATTERING
    CROSS SECTION OF 2.83+-0.11 BARNS AT 0.0253 EV/7/.
      FOR JENDL-3.2, NEUTRON WIDTHS OF 14 RESONANCES WERE REPLACED
    WITH EXPERIMENTAL DATA OBTAINED BY OHKUBO/8/ IN THE ENERGY
    RANGE FROM 2.5437 KEV TO 55.113 KEV.  PARAMETERS OF THE
    NEGATIVE RESONANCE WERE RE-ADJUSTED TO THE ABOVE THERMAL CROSS
    SECTIONS /7/.

  NO UNRESOLVED RESONANCE PARAMETERS ARE GIVEN.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           3.3995                   -
      ELASTIC         2.8299                   -
      CAPTURE         0.5697                     0.278

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 200 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 200 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY/9/, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/10/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WHICH
  WERE DETERMINED SO AS TO REPRODUCE THE LA-139 TOTAL CROSS
  SECTION MEASURED BY FOSTER AND GLASGOW/11/, ISLAM ET AL./12/,
  NISHIMURA ET AL./13/ AND SO ON WERE ADOPTED BY ASSUMING THAT
  THE TOTAL CROSS SECTION OF CE WAS SIMILER TO THAT OF LA-139.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/14/
     ALPHA    = HUIZENGA AND IGO/15/
     DEUTERON = LOHR AND HAEBERLI/16/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/17/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/18/ WERE EVALUATED BY IIJIMA ET AL./19/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /20/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./21/.

           NO.      ENERGY(MEV)    SPIN-PARITY    DWBA CAL.
           GR.       0.0             0  +
            1        1.5964          2  +            *
            2        1.9033          0  +
            3        2.0840          4  +
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4	2.1081	6	+	
5	2.3482	2	+	
6	2.3500	5	+	
7	2.4123	3	+	
8	2.4643	3	-	*
9	2.4812	4	+	
10	2.5161	3	+	
11	2.5217	2	+	
12	2.5334	1	+	
13	2.5475	2	+	
14	2.8997	2	+	
15	3.0169	0	+	
16	3.0400	3	-	
17	3.1190	2	+	
18	3.2330	0	+	
19	3.2500	5	-	

LEVELS ABOVE 3.32 MEV WERE ASSUMED TO BE OVERLAPPING.

FOR THE LEVELS WITH AN ASTERISK, THE CONTRIBUTION OF DIRECT INELASTIC SCATTERING CROSS SECTIONS WAS CALCULATED BY THE DWUCK-4 CODE/22/. DEFORMATION PARAMETERS (BETA2 = 0.1012 AND BETA3 = 0.127) WERE BASED ON THE DATA COMPILED BY RAMAN ET AL./23/ AND SPEAR/24/, RESPECTIVELY.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/25/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (6.30E-06) WAS ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION OF 5.0 MILLI-BARNS AT 70 KEV MEASURED BY MUSGROVE ET AL./26/

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT = 32 (N,N'D) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS/10/.

THE KALBACH'S CONSTANT K (= 247.8) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/27/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,P)	7.50 MB	(MEASURED BY TENG DAN+/28/)
(N,ALPHA)	4.60 MB	(RECOMMENDED BY FORREST/29/)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. CONTRIBUTION OF DIRECT INELASTIC SCATTERING WAS CALCULATED WITH DWUCK-4. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING FROM OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 41.8	R0 = 6.89	A0 = 0.62
WS = 2.95+0.789E	RS = 7.098	AS = 0.35
VSO= 7.0	RSO= 6.89	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
56-BA-136		1.610E+01	6.500E-01	5.721E-01	6.928E+00	2.280E+00
56-BA-137		1.645E+01	5.640E-01	5.394E-01	4.905E+00	1.580E+00
56-BA-138		1.390E+01	7.200E-01	4.123E-01	7.233E+00	2.430E+00
56-BA-139		2.022E+01	4.800E-01	5.326E-01	4.629E+00	1.580E+00
57-LA-137		1.558E+01	6.210E-01	3.521E+00	4.624E+00	7.000E-01
57-LA-138		1.450E+01	6.310E-01	7.202E+00	3.634E+00	0.0
57-LA-139		1.380E+01	6.500E-01	1.653E+00	4.468E+00	8.500E-01
57-LA-140		1.558E+01	5.900E-01	7.912E+00	3.425E+00	0.0
58-CE-138	*	1.618E+01	5.580E-01	2.611E-01	5.011E+00	1.870E+00
58-CE-139		1.374E+01	6.450E-01	9.282E-01	4.685E+00	1.170E+00
58-CE-140		1.413E+01	6.541E-01	3.376E-01	5.852E+00	2.020E+00
58-CE-141		1.714E+01	5.150E-01	7.134E-01	3.957E+00	1.170E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 6.125 FOR CE-140 AND 9.569 FOR CE-141.

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MAT number = 5840

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 58-CE-141 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 0.35 KEV.
      EXPERIMENTAL DATA BY ANUFRIEV ET AL./2/ FOR 6 RESONANCES
    BELOW 335 EV WERE USED FOR EVALUATION AS DESCRIBED BELOW.
    RESONANCE ENERGIES, NEUTRON AND RADIATION WIDTHS GIVEN BY
    ANUFRIEV ET AL. WERE ADOPTED FOR RECOMMENDED VALUES.  TOTAL
    SPIN J WAS DETERMINED WITH A RANDOM NUMBER METHOD.  FINALLY, A
    NEGATIVE RESONANCE WAS ADDED SO AS TO REPRODUCE THE THERMAL
    CAPTURE CROSS SECTION GIVEN BY MUGHABGHAB ET AL./3/

  UNRESOLVED RESONANCE REGION : 0.35 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/4/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.  THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS
    OF MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.560E-4, S1 = 0.780E-4, S2 = 0.590E-4, SG = 28.4E-4,
    GG = 0.070 EV, R  = 5.211 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                    2200 M/S               RES. INTEG.
      TOTAL         31.47                    -
      ELASTIC        2.349                   -
      CAPTURE       29.12                  503

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/5/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WHICH
  WERE DETERMINED SO AS TO REPRODUCE THE LA-139 TOTAL CROSS
  SECTION MEASURED BY FOSTER AND GLASGOW/6/, ISLAM ET AL./7/,
  NISHIMURA ET AL./8/ AND SO ON WERE ADOPTED BY ASSUMING THAT THE
  TOTAL CROSS SECTION OF CE WAS SIMILER TO THAT OF LA-139.  THE
  OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/9/
     ALPHA    = HUIZENGA AND IGO/10/
     DEUTERON = LOHR AND HAEBERLI/11/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/12/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/13/ WERE EVALUATED BY IIJIMA ET AL./14/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /15/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/16/ AND NUCLEAR DATA
    SHEETS/17/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             7/2 -
            1        0.6621          3/2 -
            2        1.1370          1/2 -
            3        1.3545          9/2 -
            4        1.3687         13/2 +
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             5        1.3780         9/2  -
             6        1.4970         5/2  -
             7        1.6265         3/2  +
             8        1.6933        11/2  -
             9        1.7390         7/2  -
            10        1.7850         1/2  +
            11        1.8087         3/2  -
            12        1.8120         5/2  -
            13        1.9150        11/2  -
            14        1.9420         1/2  +
            15        1.9625        15/2  +
            16        1.9940         1/2  -
            17        2.0440        11/2  -
            18        2.1130         5/2  -
            19        2.1650        11/2  -
            20        2.1660         3/2  -
            21        2.1711         9/2  -
            22        2.1740         5/2  -
            23        2.1890         5/2  -
            24        2.1896         3/2  -
            25        2.2074         7/2  +
            26        2.2090        17/2  +
            27        2.2430         7/2  +
            28        2.2630         7/2  +
            29        2.2669         5/2  +
       LEVELS ABOVE 2.274 MEV WERE ASSUMED TO BE OVERLAPPING.

   MT = 102  CAPTURE
     SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
     CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
     SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
     AND REFFO/18/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

     THE GAMMA-RAY STRENGTH FUNCTION (2.80E-03) WAS DETERMINED FROM
     THE SYSTEMATICS OF RADIATION WIDTH (0.07 EV) AND THE AVERAGE
     S-WAVE RESONANCE LEVEL SPACING (24.9 EV) CALCULATED FROM THE
     LEVEL DENSITY PARAMETERS.

   MT = 16  (N,2N) CROSS SECTION
   MT = 17  (N,3N) CROSS SECTION
   MT = 22  (N,N'A) CROSS SECTION
   MT = 28  (N,N'P) CROSS SECTION
   MT = 32  (N,N'D) CROSS SECTION
   MT = 33  (N,N'T) CROSS SECTION
   MT =103  (N,P) CROSS SECTION
   MT =104  (N,D) CROSS SECTION
   MT =105  (N,T) CROSS SECTION
   MT =107  (N,ALPHA) CROSS SECTION
     THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
     PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

     THE KALBACH'S CONSTANT K (= 311.1) WAS ESTIMATED BY THE
     FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/19/ AND LEVEL
     DENSITY PARAMETERS.

     FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
     NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
       (N,P)          4.55  MB (SYSTEMATICS OF FORREST/20/)
       (N,ALPHA)      1.99  MB (SYSTEMATICS OF FORREST)

   MT = 251  MU-BAR
     CALCULATED WITH CASTHY.

 MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
   LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
   GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
   TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
   CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
   BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

 MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
   ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
   PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
   OTHER NEUTRON EMITTING REACTIONS.

 TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                 DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
          ----------------------   ------------  ---------------
          V  = 41.8                R0 = 6.907    A0 = 0.62
          WS = 2.95+0.789E         RS = 7.115    AS = 0.35
          VSO= 7.0                 RSO= 6.907    ASO= 0.62
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THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
56-BA-137	1.645E+01	5.640E-01	5.394E-01	4.905E+00	1.580E+00
56-BA-138	1.390E+01	7.200E-01	4.123E-01	7.233E+00	2.430E+00
56-BA-139	2.022E+01	4.800E-01	5.326E-01	4.629E+00	1.580E+00
56-BA-140	1.500E+01	6.930E-01	5.738E-01	7.244E+00	2.340E+00
57-LA-138	1.450E+01	6.310E-01	7.202E+00	3.634E+00	0.0
57-LA-139	1.380E+01	6.500E-01	1.653E+00	4.468E+00	8.500E-01
57-LA-140	1.558E+01	5.900E-01	7.912E+00	3.425E+00	0.0
57-LA-141	1.894E+01	5.130E-01	3.056E+00	4.024E+00	7.600E-01
58-CE-139	1.374E+01	6.450E-01	9.282E-01	4.685E+00	1.170E+00
58-CE-140	1.413E+01	6.541E-01	3.376E-01	5.852E+00	2.020E+00
58-CE-141	1.714E+01	5.150E-01	7.134E-01	3.957E+00	1.170E+00
58-CE-142	1.600E+01	6.000E-01	4.210E-01	5.674E+00	1.930E+00

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 9.569 FOR CE-141 AND 3.236 FOR CE-142.

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MAT number = 5843

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 58-CE-142 JNDC        EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                       DIST-SEP90 REV2-SEP93
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.
93-09 JENDL-3.2 WAS MADE BY JNDC FPND W.G.

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)       UNRESOLVED RESONANCE PARAMETERS RE-ADJUSTED
                    SO AS TO REPRODUCE THE RE-NORMALIZED CAPTURE
                    CROSS SECTION.
      (3,102)       RE-NORMALIZATION.
      (3,2), (3,4), (3,51-91) AND ANGULAR DISTRIBUTIONS
                    SMALL EFFECTS OF THE RE-NORMALIZATION OF
                    CAPTURE CROSS SECTION.
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MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 26 KEV
      RESONANCE PARAMETERS FOR JENDL-3 WERE EVALUATED BY TAKING
    INTO ACCOUNT THE EXPERIMENTAL DATA BY OHKUBO ET AL./3/ IN
    WHICH REDUCED NEUTRON WIDTHS WERE GIVEN IN THE ENERGY RANGE
    FROM 1.277 TO 54.9 KEV.  THE UPPER BOUNDARY OF RESOLVED
    RESONANCE REGION WAS DETERMINED TO BE 26 KEV AS A RESULT OF
    STAIR-CASE PLOTTING.
      AVERAGE RADIATION WIDTH OF 0.08 EV WAS ESTIMATED FROM FIG. 9
    IN REF./4/ AND THE SYSTEMATICS CURVE BY BENZI AND REFFO/5/.
    SCATTERING RADIUS OF 5.9 FM WAS ADOPTED FROM THE COMPILATION
    BY MUGHABGHAB ET AL./4/
      NEUTRON ORBITAL ANGULAR MOMENTUM L OF SOME RESONANCES WAS
    ESTIMATED WITH A METHOD OF BOLLINGER AND THOMAS/6/.
      A NEGATIVE RESONANCE WAS ADDED SO AS TO REPRODUCE THE
    THERMAL CAPTURE CROSS SECTION OF 0.95+-0.05 BARN RECOMMENDED
    BY MUGHABGHAB ET AL.

  UNRESOLVED RESONANCE REGION : 26 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTION S0 WAS BASED ON THE COMPILATION
    OF MUGHABGHAB ET AL., AND S1 AND S2 WERE CALCULATED WITH
    OPTICAL MODEL CODE CASTHY/7/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS OF
    MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 1.200E-4, S1 = 0.700E-4, S2 = 0.600E-4, SG = 0.233E-4,
    GG = 0.070 EV, R  = 4.537 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                      2200 M/S               RES. INTEG.
      TOTAL           1.618                     -
      ELASTIC         0.6145                    -
      CAPTURE         1.004                      0.933

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/8/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WHICH
  WERE DETERMINED SO AS TO REPRODUCE THE LA-139 TOTAL CROSS
  SECTION MEASURED BY FOSTER AND GLASGOW/9/, ISLAM ET AL./10/,
  NISHIMURA ET AL./11/ AND SO ON WERE ADOPTED BY ASSUMING THAT THE
  TOTAL CROSS SECTION OF CE WAS SIMILER TO THAT OF LA-139.  THE
  OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/12/
     ALPHA    = HUIZENGA AND IGO/13/
     DEUTERON = LOHR AND HAEBERLI/14/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/15/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/16/ WERE EVALUATED BY IIJIMA ET AL./17/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
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/18/.

MT = 1  TOTAL
  SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

MT = 2  ELASTIC SCATTERING
  CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

MT = 4, 51 - 91  INELASTIC SCATTERING
  SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
  ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./19/.

         NO.      ENERGY(MEV)    SPIN-PARITY    DWBA CAL.
         GR.       0.0             0  +
          1        0.6412          2  +             *
          2        1.2193          4  +
          3        1.5361          2  +
          4        1.6526          3  -             *
          5        2.0042          2  +
          6        2.0300          0  +
          7        2.1870          1  +
          8        2.3640          1  +
          9        2.3980          1  +
    LEVELS ABOVE 2.5 MEV WERE ASSUMED TO BE OVERLAPPING.

  FOR THE LEVELS WITH AN ASTERISK, THE CONTRIBUTION OF DIRECT
  INELASTIC SCATTERING CROSS SECTIONS WAS CALCULATED BY THE
  DWUCK-4 CODE/20/.  DEFORMATION PARAMETERS (BETA2 = 0.1236 AND
  BETA3 = 0.132) WERE BASED ON THE DATA COMPILED BY RAMAN ET
  AL./21/ AND SPEAR/22/, RESPECTIVELY.

MT = 102  CAPTURE
  SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
  CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
  SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
  AND REFFO/5/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

  THE GAMMA-RAY STRENGTH FUNCTION (2.06E-05) WAS DETERMINED SO A
  TO REPRODUCE THE CAPTURE CROSS SECTION OF 19+-4 MB AT 25 KEV
  MEASURED BY R.P. ANAND ET AL./23/

MT = 16  (N,2N) CROSS SECTION
MT = 17  (N,3N) CROSS SECTION
MT = 22  (N,N'A) CROSS SECTION
MT = 28  (N,N'P) CROSS SECTION
MT = 32  (N,N'D) CROSS SECTION
MT = 33  (N,N'T) CROSS SECTION
MT =103  (N,P) CROSS SECTION
MT =104  (N,D) CROSS SECTION
MT =105  (N,T) CROSS SECTION
MT =107  (N,ALPHA) CROSS SECTION
  THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
  PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

  THE KALBACH'S CONSTANT K (= 100.0) WAS DETERMINED TO REPRODUCE
  ENERGY DEPENDENCE OF THE (N,2N) CROSS SECTION MEASURED BY
  TENG DAN ET AL./24/.

  FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
  NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
    (N,P)           4.80  MB (RECOMMENDED BY FORREST/25/)
    (N,ALPHA)       3.00  MB (RECOMMENDED BY FORREST)
  THE (N,2N) CROSS SECTION WAS MODIFIED BY EYE-GUIDING OF THE
  DATA MEASURED BY TENG DAN ET AL./24/  THE (N,3N) CROSS SECTION
  WAS DETERMINED BY SUBTRACTING THE (N,2N) CROSS SECTION FROM
  THE SUM OF (N,2N) AND (N,3N) CROSS SECTIONS CALCULATED WITH
  PEGASUS.

MT = 251  MU-BAR
  CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  CONTRIBUTION OF DIRECT INELASTIC
  SCATTERING WAS CALCULATED WITH DWUCK-4.  FOR OTHER REACTIONS,
  ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING FROM OVERLAPPING LEVELS AND FOR
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OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 41.8	R0 = 6.923	A0 = 0.62
WS = 2.95+0.789E	RS = 7.132	AS = 0.35
VSO= 7.0	RSO= 6.923	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
56-BA-138	1.390E+01	7.200E-01	4.123E-01	7.233E+00	2.430E+00
56-BA-139	2.022E+01	4.800E-01	5.326E-01	4.629E+00	1.580E+00
56-BA-140	1.500E+01	6.930E-01	5.738E-01	7.244E+00	2.340E+00
56-BA-141	1.600E+01	7.010E-01	3.318E+00	7.141E+00	1.580E+00
57-LA-139	1.380E+01	6.500E-01	1.653E+00	4.468E+00	8.500E-01
57-LA-140	1.558E+01	5.900E-01	7.912E+00	3.425E+00	0.0
57-LA-141	1.894E+01	5.130E-01	3.056E+00	4.024E+00	7.600E-01
57-LA-142	2.026E+01	4.610E-01	1.125E+01	2.749E+00	0.0
58-CE-140	1.413E+01	6.541E-01	3.376E-01	5.852E+00	2.020E+00
58-CE-141	1.714E+01	5.150E-01	7.134E-01	3.957E+00	1.170E+00
58-CE-142	1.600E+01	6.000E-01	4.210E-01	5.674E+00	1.930E+00
58-CE-143	1.900E+01	5.500E-01	2.613E+00	5.094E+00	1.170E+00

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 3.236 FOR CE-142 AND 5.0 FOR CE-143.

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MAT number = 5849

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 58-CE-144 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  NO RESOLVED RESONANCE PARAMETERS
    NO EXPERIMENTAL DATA WERE AVAILABLE.

  UNRESOLVED RESONANCE REGION : 50 EV - 100 KEV
    THE LOWER BOUNDARY OF 50 EV WAS DETERMINED SO THAT THE CAPTURE
    RESONANCE INTEGRAL MIGHT AGREE WITH THE RECOMMENDED DATA IN
    REF./3/.  THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE
    CALCULATED WITH OPTICAL MODEL CODE CASTHY/4/.  THE OBSERVED
    LEVEL SPACING WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS
    SECTION CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING
    RADIUS WAS OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS
    SECTION AT 100 KEV.  THE RADIATION WIDTH GG WAS BASED ON THE
    SYSTEMATICS OF MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 0.700E-4, S1 = 0.700E-4, S2 = 0.700E-4, SG = 0.308E-4,
    GG = 0.060 EV, R  = 4.880 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           3.780                   -
      ELASTIC         2.780                   -
      CAPTURE         1.000                    2.55

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 50 EV, THE CAPTURE AND ELASTIC SCATTERING CROSS SECTIONS
  WERE ASSUMED TO BE IN 1/V FORM AND CONSTANT, RESPECTIVELY.  THE
  CAPTURE CROSS SECTION AT 0.0253 EV WAS TAKEN FROM REF./3/, AND
  THE ELASTIC SCATTERING CROSS SECTION WAS ESTIMATED BY ASSUMING
  R = 4.7 FM.  UNRESOLVED RESONANCE PARAMETERS WERE GIVEN IN THE
  ENERGY RANGE FROM 50 EV TO 100 KEV.

  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/5/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WHICH
  WERE DETERMINED SO AS TO REPRODUCE THE LA-139 TOTAL CROSS
  SECTION MEASURED BY FOSTER AND GLASGOW/6/, ISLAM ET AL./7/,
  NISHIMURA ET AL./8/ AND SO ON WERE ADOPTED BY ASSUMING THAT THE
  TOTAL CROSS SECTION OF CE WAS SIMILER TO THAT OF LA-139.  THE
  OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/9/
     ALPHA    = HUIZENGA AND IGO/10/
     DEUTERON = LOHR AND HAEBERLI/11/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/12/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/13/ WERE EVALUATED BY IIJIMA ET AL./14/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /15/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./16/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0              0  +
            1        0.3973           2  +
            2        0.9384           4  +
      LEVELS ABOVE 1.242 MEV WERE ASSUMED TO BE OVERLAPPING.
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  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/17/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (2.80E-05) WAS DETERMINED FROM
    THE SYSTEMATICS OF RADIATION WIDTH (0.06 EV) AND AVERAGE
    S-WAVE RESONANCE LEVEL SPACING (2150 EV).

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT = 32  (N,N'D) CROSS SECTION
  MT = 33  (N,N'T) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (= 100.0) WAS ASSUMED TO BE THE SAME
    AS THAT OF CE-142.

    FINALLY, THE (N,P) CROSS SECTION WAS NORMALIZED TO THE
    FOLLOWING VALUE AT 14.5 MEV:
      (N,P)          1.98  MB (SYSTEMATICS OF FORREST/18/)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                DEPTH (MEV)         RADIUS(FM)    DIFFUSENESS(FM)
         ----------------------     ------------  ---------------
        V  = 41.8                   R0 = 6.955    A0 = 0.62
        WS = 2.95+0.789E            RS = 7.165    AS = 0.35
        VSO= 7.0                    RSO= 6.955    ASO= 0.62
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2  LEVEL DENSITY PARAMETERS

 NUCLIDE  SYST A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
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 56-BA-140      1.500E+01 6.930E-01 5.738E-01 7.244E+00 2.340E+00
 56-BA-141      1.600E+01 7.010E-01 3.318E+00 7.141E+00 1.580E+00
 56-BA-142  *   2.045E+01 5.484E-01 4.211E-01 6.848E+00 2.500E+00
 56-BA-143  *   2.216E+01 5.459E-01 4.559E+00 6.410E+00 1.580E+00

 57-LA-141      1.894E+01 5.130E-01 3.056E+00 4.024E+00 7.600E-01
 57-LA-142      2.026E+01 4.610E-01 1.125E+01 2.749E+00 0.0
 57-LA-143  *   2.059E+01 5.459E-01 7.647E+00 5.265E+00 9.200E-01
 57-LA-144      1.843E+01 4.930E-01 8.672E+00 2.805E+00 0.0

 58-CE-142      1.600E+01 6.000E-01 4.210E-01 5.674E+00 1.930E+00
 58-CE-143      1.900E+01 5.500E-01 2.613E+00 5.094E+00 1.170E+00
 58-CE-144      1.700E+01 6.000E-01 5.074E-01 6.214E+00 2.090E+00
 58-CE-145      2.100E+01 5.500E-01 6.213E+00 5.723E+00 1.170E+00
 ---------------------------------------------------------------
  SYST:  * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

 SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
 IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
 ASSUMED TO BE 5.0 FOR CE-144 AND 5.0 FOR CE-145.
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MAT number = 5925
 59-PR-141 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-SEP90 REV2-NOV93
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.
93-10 JENDL-3.2 WAS MADE BY JNDC FPND W.G.

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)       RESOLVED RESONANCE PARAMETERS
     ***********************************************************


MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE PARAMETERS FOR MLBW FORMULA (BELOW 13.226KEV)
    RESONANCE PARAMETERS WERE TAKEN FROM JENDL-2/3/ AND SLIGHTLY
    MODIFIED.
      IN THE EVALUATION FOR JENDL-2, NEUTRON WIDTHS WERE EVALUATED
    ON THE BASIS OF WYNCHANK ET AL./4/, MORGENSTERN ET AL./5/ AND
    TAYLOR ET AL./6/ RADIATION WIDTHS WERE DETERMINED FROM CAPTURE
    AREAS MEASURED BY TAYLOR ET AL.  FOR THE LEVELS WHOSE CAPTURE
    ARIA WAS ONLY THE EXISTING DATA, THEIR NEUTRON WIDTHS WERE
    DEDUCED BY ASSUMING THE AVERAGE RADIATION WIDTH OF 0.084+-
    0.024 EV.  SCATTERING RADIUS OF 4.9 FM WAS ADOPTED FROM
    MUGHABGHAB ET AT./7/
      FOR JENDL-3, PARAMETERS OF A NEGATIVE RESONANCE WERE
    MODIFIED SO AS TO REPRODUCE THE CAPTURE CROSS SECTION OF
    11.5+-0.3 BARNS AT 0.0253 EV/7/ AND THE TOTAL CROSS SECTION
    MEASURED BY ZIMMERMAN ET AL./8/ AND HICKMAN/9/.  TOTAL SPIN J
    OF SOME RESONANCES WAS TENTATIVELY ESTIMATED WITH A RANDOM
    NUMBER METHOD.
      FOR JENDL-3.2, THESE RESONANCE PARAMETERS WERE MODIFIED SO
    AS TO REPRODUCE THE CAPTURE AREA DATA MEASURED AT ORNL, BY
    TAKING ACCOUNT OF THE CORRECTION FACTOR OF 1.0737 ANNOUNCED BY
    ALLEN ET AL./10/.

  UNRESOLVED RESONANCE REGION : 13.226 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTION S0 WAS BASED ON THE COMPILATION
    OF MUGHABGHAB ET AL., AND S1 AND S2 WERE CALCULATED WITH
    OPTICAL MODEL CODE CASTHY/11/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS OF
    MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 1.500E-4, S1 = 1.200E-4, S2 = 1.500E-4, SG = 6.06E-4,
    GG = 0.086 EV, R  = 5.181 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL         14.040                     -
      ELASTIC        2.540                     -
      CAPTURE       11.500                   18.4

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/12/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  ADOPTED FROM MOLDAUER/13/ SINCE THE PARAMETERS REPRODUCED WELL
  THE TOTAL CROSS SECTION MEASURED BY FOSTER AND GLASGOW/14/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/15/
     ALPHA    = HUIZENGA AND IGO/16/
     DEUTERON = LOHR AND HAEBERLI/17/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/18/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/19/ WERE EVALUATED BY IIJIMA ET AL./20/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /21/.
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  MT = 1  TOTAL
    BELOW 5 MEV, SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.
    ABOVE 5 MEV, EYE-GUIDING WAS MADE ON THE BASIS OF THE DATA
    MEASURED BY FOSTER AND GLASGOW/14/.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./22/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.        0.0            5/2 +
            1         0.1454         7/2 +
            2         1.1180        11/2 -
            3         1.1270         3/2 +
            4         1.2927         5/2 +
            5         1.2986         1/2 +
            6         1.4350         3/2 +
            7         1.4502         7/2 +
            8         1.4561         5/2 -
      LEVELS ABOVE 1.48 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/23/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (6.38E-04) WAS ADJUSTED TO THE
    CAPTURE CROSS SECTION OF 110 MILLI-BARNS AT 30 KEV MEASURED BY
    MUSGROVE ET AL./24/  THE RESULTS WERE MODIFIED BY MULTIPLING
    WITH AN ENERGY DEPENDENT FACTOR TO REPRODUCE WELL THE EXPERI-
    MENTAL DATA SUCH AS THOSE MEASURED BY ZAIKIN ET AL./25/ AND
    STUPEGIA ET AL./26/


  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT = 32  (N,N'D) CROSS SECTION
  MT = 33  (N,N'T) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =106  (N,HE3) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (= 314.1) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/27/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,P)           9.50  MB (RECOMMENDED BY FORREST/28/)
      (N,ALPHA)       3.00  MB (RECOMMENDED BY FORREST)
    THE (N,2N) CROSS SECTION WAS DETERMINED BY EYE-GUIDING OF
    THE DATA MEASURED BY BORMANN ET AL./29/.

    THE (N,ALPHA) CROSS SECTION BELOW 13.225 KEV WAS CALCULATED
    FROM RESONANCE PARAMETERS, BY ASSUMING A MEAN ALPHA WIDTH OF
    1.15E-8 EV SO AS TO REPRODUCE THE THERMAL CROSS SECTION/7/.
    THE CROSS SECTION WAS AVERAGED IN SUITABLE ENERGY INTERVALS.
    ABOVE 13.225 KEV, THE CROSS SECTION WAS CONNECTED SMOOTHLY TO
    THE PEGASUS CALCULATION.

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
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PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

	DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
	V = 46.0	R0 = 6.638	A0 = 0.62
	WS = 7.0	RS = 6.638	AS = 1.0
	VSO= 7.0	RSO= 6.638	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS GAUSSIAN TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
57-LA-137		1.558E+01	6.210E-01	3.521E+00	4.624E+00	7.000E-01
57-LA-138		1.450E+01	6.310E-01	7.202E+00	3.634E+00	0.0
57-LA-139		1.380E+01	6.500E-01	1.653E+00	4.468E+00	8.500E-01
57-LA-140		1.558E+01	5.900E-01	7.912E+00	3.425E+00	0.0
58-CE-138	*	1.618E+01	5.580E-01	2.611E-01	5.011E+00	1.870E+00
58-CE-139		1.374E+01	6.450E-01	9.282E-01	4.685E+00	1.170E+00
58-CE-140		1.413E+01	6.541E-01	3.376E-01	5.852E+00	2.020E+00
58-CE-141		1.714E+01	5.150E-01	7.134E-01	3.957E+00	1.170E+00
59-PR-139	*	1.630E+01	5.556E-01	2.158E+00	3.843E+00	7.000E-01
59-PR-140		1.448E+01	6.430E-01	7.927E+00	3.814E+00	0.0
59-PR-141		1.400E+01	6.500E-01	1.810E+00	4.559E+00	8.500E-01
59-PR-142		1.595E+01	6.150E-01	1.201E+01	3.974E+00	0.0

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 5.937 FOR PR-141 AND 5.267 FOR PR-142.

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MAT number = 5931

59-PR-143 JNDC EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
DIST-NOV90

HISTORY

90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND W.G./1/

MF = 1 GENERAL INFORMATION

MT=451 COMMENTS AND DICTIONARY

MF = 2 RESONANCE PARAMETERS

MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS

NO RESOLVED RESONANCE PARAMETERS BECAUSE NO EXPERIMENTAL DATA WERE AVAILABLE.

UNRESOLVED RESONANCE REGION : 4 EV - 100 KEV

THE LOWER BOUNDARY OF 4 EV WAS DETERMINED SO AS TO REPRODUCE WELL THE CAPTURE RESONANCE INTEGRAL OF 190+-25 BARNS/2/. THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED WITH OPTICAL MODEL CODE CASTHY/3/. THE OBSERVED LEVEL SPACING WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED WITH CASTHY. THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV. THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS OF MEASURED VALUES FOR NEIGHBORING NUCLIDES.

TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:

S0 = 2.300E-4, S1 = 1.100E-4, S2 = 1.700E-4, SG = 5.98E-4,
GG = 0.065 EV, R = 4.479 FM.

CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)

	2200 M/S	RES. INTEG.
TOTAL	92.90	-
ELASTIC	2.900	-
CAPTURE	90.00	185

MF = 3 NEUTRON CROSS SECTIONS

BELOW 4 EV, THE CAPTURE AND ELASTIC SCATTERING CROSS SECTIONS WERE ASSUMED TO BE IN 1/V FORM AND CONSTANT, RESPECTIVELY. THE CAPTURE CROSS SECTION AT 0.0253 EV WAS TAKEN FROM REF./2/, AND THE ELASTIC SCATTERING CROSS SECTION WAS ESTIMATED BY ASSUMING R = 4.8 FM. UNRESOLVED RESONANCE PARAMETERS WERE GIVEN IN THE ENERGY RANGE FROM 4 EV TO 100 KEV.

ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED WITH PEGASUS/4/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL. THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE ADOPTED FROM MOLDAUER/5/ SINCE THE PARAMETERS REPRODUCED WELL THE TOTAL CROSS SECTION MEASURED BY FOSTER AND GLASGOW/6/. THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:

PROTON = PEREY/7/
ALPHA = HUIZENGA AND IGO/8/
DEUTERON = LOHR AND HAEBERLI/9/
HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/10/

PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT AND CAMERON/11/ WERE EVALUATED BY IIJIMA ET AL./12/ MORE EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE PRESENT WORK. TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED IN THE PRESENT CALCULATION. ENERGY DEPENDENCE OF SPIN CUT-OFF PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR /13/.

MT = 1 TOTAL

SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

MT = 2 ELASTIC SCATTERING

CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

MT = 4, 51 - 91 INELASTIC SCATTERING

SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR STRUCTURE DATA FILE (1987 VERSION)/14/ AND NUCLEAR DATA SHEETS/15/.

NO.	ENERGY(MEV)	SPIN-PARITY
GR.	0.0	7/2 +
1	0.0574	5/2 +
2	0.3506	3/2 +
3	0.4904	7/2 +
4	0.7219	5/2 +

5	0.7401	1/2 -
6	0.9378	3/2 +
7	1.0603	5/2 +
8	1.1604	3/2 +
9	1.3820	3/2 +
10	1.3977	1/2 -

LEVELS ABOVE 1.526 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/16/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (6.24E-04) WAS DETERMINED FROM THE SYSTEMATICS OF RADIATION WIDTH (0.065 EV) AND THE AVERAGE S-WAVE RESONANCE LEVEL SPACING (104 EV) CALCULATED FROM THE LEVEL DENSITY PARAMETERS.

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT = 32 (N,N'D) CROSS SECTION
MT = 33 (N,N'T) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =106 (N,HE3) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 324.5) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/17/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,P)	5.29 MB	(SYSTEMATICS OF FORREST/18/)
(N,ALPHA)	2.22 MB	(SYSTEMATICS OF FORREST)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 46.0	R0 = 6.666	A0 = 0.62
WS = 7.0	RS = 6.666	AS = 1.0
VSO= 7.0	RSO= 6.666	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS GAUSSIAN TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
57-LA-139	1.380E+01	6.500E-01	1.653E+00	4.468E+00	8.500E-01
57-LA-140	1.558E+01	5.900E-01	7.912E+00	3.425E+00	0.0
57-LA-141	1.894E+01	5.130E-01	3.056E+00	4.024E+00	7.600E-01
57-LA-142	2.026E+01	4.610E-01	1.125E+01	2.749E+00	0.0
58-CE-140	1.413E+01	6.541E-01	3.376E-01	5.852E+00	2.020E+00
58-CE-141	1.714E+01	5.150E-01	7.134E-01	3.957E+00	1.170E+00
58-CE-142	1.600E+01	6.000E-01	4.210E-01	5.674E+00	1.930E+00
58-CE-143	1.900E+01	5.500E-01	2.613E+00	5.094E+00	1.170E+00
59-PR-141	1.400E+01	6.500E-01	1.810E+00	4.559E+00	8.500E-01
59-PR-142	1.595E+01	6.150E-01	1.201E+01	3.974E+00	0.0

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59-PR-143     1.500E+01 6.280E-01 2.607E+00 4.558E+00 7.600E-01
59-PR-144     1.600E+01 6.000E-01 1.045E+01 3.744E+00 0.0
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SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 3.050 FOR PR-143 AND 5.0 FOR PR-144.

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MAT number = 6025
 60-ND-142 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-SEP90 REV2-NOV93
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.
93-11 JENDL-3.2 WAS MADE BY JNDC FPND W.G.

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)       RESOLVED RESONANCE PARAMETERS
     ***********************************************************


MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE PARAMETERS FOR MLBW FORMULA (BELOW 26.0 KEV)
    RESONANCE PARAMETERS WERE TAKEN FROM JENDL-2/3/ AFTER THE
    FOLLOWING MODIFICATION.
       EVALUATION FOR JENDL-2 WAS MADE BY MAINLY ON THE BASIS OF
    THE DATA MEASURED BY TELLIER/4/ AND MUSGROVE ET AL./5/
    RESONANCE ENERGIES WERE ADJUSTED TO THOSE OF TELLIER.  AVERAGE
    RADIATION WIDTHS WERE ASSUMED TO BE 0.078 EV FOR S-WAVE AND
    SOME LARGE P-WAVE RESONANCES AND TO BE 0.046 EV FOR P-WAVE
    ONES.
       FOR JENDL-3, PARAMETERS OF A NEGATIVE RESONANCE WAS
    MODIFIED SO AS TO REPRODUCE THE THERMAL CAPTURE CROSS SECTION
    OF 18.7+-0.7 BARNS/6/ AND THE RESONANCE INTEGRAL.  HOWEVER,
    THE CALCULATED RESONANCE INTEGRAL IS STILL TOO SMALL.
      FOR JENDL-3.2, THESE RESONANCE PARAMETERS WERE MODIFIED SO
    AS TO REPRODUCE THE CAPTURE AREA DATA MEASURED AT ORNL, BY
    TAKING ACCOUNT OF THE CORRECTION FACTOR (0.967) ANNOUNCED BY
    ALLEN ET AL./7/.  THE PARAMETERS OF A NEGATIVE RESONANCE AND
    SCATTERING RADIUS WERE ADJUSETED TO GET BETTER AGREEMENT WITH
    RECOMMENDED THERMAL CROSS SECTIONS/8/.

  UNRESOLVED RESONANCE REGION : 26 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS S0 AND S1 WERE BASED ON THE
    COMPILATION OF MUGHABGHAB ET AL./8/, AND S2 WAS CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/9/.  THE OBSERVED LEVEL
    SPACING WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION
    AT 100 KEV.  THE RADIATION WIDTHS GG(S) AND GG(P) WERE BASED
    ON THE COMPILATION OF MUGHABGHAB ET AL.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 1.500E-4, S1 = 0.400E-4, S2 = 1.700E-4, SG(S)= 1.24E-4,
    SG(P)=0.828E-4, GG(S)=0.064 EV, GG(P)= 0.044 EV, R= 5.805 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL          26.400                    -
      ELASTIC         7.700                    -
      CAPTURE        18.700                   8.68

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/10/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  ADOPTED FROM THE PARAMETERS DETERMINED BY IIJIMA AND KAWAI/11/
  FOR ND-143.  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/12/
     ALPHA    = HUIZENGA AND IGO/13/
     DEUTERON = LOHR AND HAEBERLI/14/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/15/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/16/ WERE EVALUATED BY IIJIMA ET AL./17/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /18/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.
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  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./19/.

           NO.      ENERGY(MEV)    SPIN-PARITY    DWBA CAL.
           GR.        0.0            0  +
            1         1.5757         2  +             *
            2         2.0844         3  -             *
            3         2.1010         4  +
            4         2.2090         6  +
            5         2.2172         0  +
            6         2.3400         2  +
            7         2.3846         1  +
            8         2.5833         2  +
            9         2.8000         4  +
           10         2.8459         2  +
           11         2.9780         0  +
      LEVELS ABOVE 3.008 MEV WERE ASSUMED TO BE OVERLAPPING.

    FOR THE LEVELS WITH AN ASTERISK, THE CONTRIBUTION OF DIRECT
    INELASTIC SCATTERING CROSS SECTIONS WAS CALCULATED BY THE
    DWUCK-4 CODE/20/.  DEFORMATION PARAMETERS (BETA2 = 0.0926 AND
    BETA3 = 0.109) WERE BASED ON THE DATA COMPILED BY RAMAN ET
    AL./21/ AND SPEAR/22/, RESPECTIVELY.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/23/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (0.969E-4) WAS ADJUSTED TO
    REPRODUCE THE CAPTURE CROSS SECTION OF 59.0 MILLI-BARNS AT 30
    KEV MEASURED BY MUSGROVE ET AL./5,7/

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT = 32  (N,N'D) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =106  (N,HE3) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (= 213.8) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/24/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,P)          13.80  MB (RECOMMENDED BY FORREST/25/)
      (N,ALPHA)       6.80  MB (RECOMMENDED BY FORREST)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  CONTRIBUTION OF DIRECT INELASTIC
  SCATTERING WAS CALCULATED WITH DWUCK-4.  FOR OTHER REACTIONS,
  ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                DEPTH (MEV)       RADIUS(FM)   DIFFUSENESS(FM)
         ----------------------  ------------  ---------------
        V  = 45.76               R0 = 6.73     A0 = 0.6
        WS = 6.97                RS = 6.417    AS = 0.45
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VSO= 7.0 RSO= 6.678 ASO= 0.6
THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
58-CE-138	*	1.618E+01	5.580E-01	2.611E-01	5.011E+00	1.870E+00
58-CE-139		1.374E+01	6.450E-01	9.282E-01	4.685E+00	1.170E+00
58-CE-140		1.413E+01	6.541E-01	3.376E-01	5.852E+00	2.020E+00
58-CE-141		1.714E+01	5.150E-01	7.134E-01	3.957E+00	1.170E+00
59-PR-139	*	1.630E+01	5.556E-01	2.158E+00	3.843E+00	7.000E-01
59-PR-140		1.448E+01	6.430E-01	7.927E+00	3.814E+00	0.0
59-PR-141		1.400E+01	6.500E-01	1.810E+00	4.559E+00	8.500E-01
59-PR-142		1.595E+01	6.150E-01	1.201E+01	3.974E+00	0.0
60-ND-140	*	1.641E+01	5.532E-01	2.596E-01	5.024E+00	1.880E+00
60-ND-141		1.477E+01	6.091E-01	9.537E-01	4.587E+00	1.180E+00
60-ND-142		1.288E+01	6.710E-01	2.250E-01	5.526E+00	2.030E+00
60-ND-143		1.826E+01	4.710E-01	5.220E-01	3.613E+00	1.180E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 5.579 FOR ND-142 AND 7.227 FOR ND-143.

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MAT number = 6028

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 60-ND-143 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-SEP90 REV2-NOV93
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.
93-11 JENDL-3.2 WAS MADE BY JNDC FPND W.G.

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)       RESOLVED RESONANCE PARAMETERS
     ***********************************************************


MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 5 KEV
       FOR JENDL-2, RESONANCE ENERGIES WERE ADOPTED FROM
    TELLIER/3/, AND THOSE NOT MEASURED BY TELLIER WERE TAKEN FROM
    ROHR ET AL./4/ AND MUSGROVE ET AL./5/ AFTER NORMALIZATION TO
    TELLIER'S DATA.  RADIATION WIDTHS WERE DERIVED FROM CAPTURE
    AREAS MEASURED BY ROHR ET AL. BELOW 2 KEV AND MUSGROVE ET AL.
    ABOVE 2.5 KEV.  FOR THE RESONANCES NOT MEASURED BY TELLIER,
    NEUTRON WIDTHS WERE DETERMINED FROM CAPTURE AREAS BY ASSUMING
    THE AVERAGE RADIATION WIDTHS OF 0.077 EV FOR S-WAVE RESONANCES
    AND 0.085 EV FOR P-WAVE ONES.  SCATTERING RADIUS WAS
    DETERMINED FROM SYSTEMATICS OF MEASURED VALUES.  A NEGATIVE
    RESONANCE WAS ADDED AT -6 EV SO AS TO REPRODUCE THE CAPTURE
    CROSS SECTION OF 325+-10 BARNS COMPILED BY MUGHABGHAB ET
    AL./6/
       FOR JENDL-3, TOTAL SPIN J OF SOME RESONANCES WAS ESTIMATED
    WITH A RANDOM NUMBER METHOD.
       FOR JENDL-3.2, THESE RESONANCE PARAMETERS WERE MODIFIED SO
    AS TO REPRODUCE THE CAPTURE AREA DATA MEASURED AT ORNL, BY
    TAKING ACCOUNT OF THE CORRECTION FACTOR (0.9507) ANNOUNCED BY
    ALLEN ET AL./7/.  THE PARAMETERS OF A NEGATIVE RESONANCE AND
    SCATTERING RADIUS WERE ADJUSETED TO GET BETTER AGREEMENT WITH
    RECOMMENDED THERMAL CROSS SECTIONS/6/.

  UNRESOLVED RESONANCE REGION : 5 KEV - 100 KEV
    UNRESOLVED RESONANCE PARAMETARS WERE ADOPTED FROM JENDL-2.
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/8/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY AT 10 KEV.  THE EFFECTIVE SCATTERING
    RADIUS WAS OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS
    SECTION AT 100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 2.624E-4, S1 = 1.042E-4, S2 = 1.783E-4, SG = 21.4E-4,
    GG = 0.079 EV, R  = 4.143 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL         408.2                     -
      ELASTIC        78.29                    -
      CAPTURE       329.9                   130
     (N,ALPHA)        0.0174

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/9/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS
  SECTION BY CHANGING RO OF IIJIMA-KAWAI POTENTIAL/10/.  THE OMP'S
  FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/11/
     ALPHA    = HUIZENGA AND IGO/12/
     DEUTERON = LOHR AND HAEBERLI/13/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/14/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/15/ WERE EVALUATED BY IIJIMA ET AL./16/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /17/.
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```
  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./18/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             7/2 -
            1        0.7418          3/2 -
            2        1.2296         13/2 +
            3        1.3060          1/2 -
            4        1.4079          9/2 -
            5        1.4320         11/2 +
            6        1.5100          1/2 +
            7        1.5400          3/2 +
            8        1.5600          5/2 -
            9        1.6100          1/2 +
           10        1.7500          9/2 -
           11        1.7670          3/2 +
      LEVELS ABOVE 1.8 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/19/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (2.15E-03) WAS ADJUSTED TO
    REPRODUCE THE CAPTURE CROSS SECTION OF 280 MILLI-BARNS AT 30
    KEV MEASURED BY NAKAJIMA ET AL./20/

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT = 32  (N,N'D) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =106  (N,HE3) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (= 239.3) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/21/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,P)          11.00  MB (RECOMMENDED BY FORREST/22/)
      (N,ALPHA)       4.02  MB (SYSTEMATICS OF FORREST/22/)

    THE (N,ALPHA) CROSS SECTION BELOW 5 KEV WAS CALCULATED FROM
    RESONANCE PARAMETERS, BY ASSUMING A MEAN ALPHA WIDTH OF
    3.48E-6 EV SO AS TO REPRODUCE THE THERMAL CROSS SECTION/6/.
    THE CROSS SECTION WAS AVERAGED IN SUITABLE ENERGY INTERVALS.
    ABOVE 5 KEV, THE CROSS SECTION WAS CONNECTED SMOOTHLY TO THE
    PEGASUS CALCULATION.

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS
```

	DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
	V = 45.76	R0 = 6.746	A0 = 0.6
	WS = 6.97	RS = 6.432	AS = 0.45
	VSO= 7.0	RSO= 6.694	ASO= 0.6

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
58-CE-139	1.374E+01	6.450E-01	9.282E-01	4.685E+00	1.170E+00
58-CE-140	1.413E+01	6.541E-01	3.376E-01	5.852E+00	2.020E+00
58-CE-141	1.714E+01	5.150E-01	7.134E-01	3.957E+00	1.170E+00
58-CE-142	1.600E+01	6.000E-01	4.210E-01	5.674E+00	1.930E+00
59-PR-140	1.448E+01	6.430E-01	7.927E+00	3.814E+00	0.0
59-PR-141	1.400E+01	6.500E-01	1.810E+00	4.559E+00	8.500E-01
59-PR-142	1.595E+01	6.150E-01	1.201E+01	3.974E+00	0.0
59-PR-143	1.500E+01	6.280E-01	2.607E+00	4.558E+00	7.600E-01
60-ND-141	1.477E+01	6.091E-01	9.537E-01	4.587E+00	1.180E+00
60-ND-142	1.288E+01	6.710E-01	2.250E-01	5.526E+00	2.030E+00
60-ND-143	1.826E+01	4.710E-01	5.220E-01	3.613E+00	1.180E+00
60-ND-144	1.771E+01	5.640E-01	4.792E-01	5.691E+00	1.940E+00

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 7.227 FOR ND-143 AND 8.725 FOR ND-144.

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MAT number = 6031
 60-ND-144 JNDC         EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                        DIST-SEP90 REV2-OCT93
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.
93-10 JENDL-3.2 WAS MADE BY JNDC FPND W.G.

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)       RESOLVED RESONANCE PARAMETERS
     ***********************************************************


MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE PARAMETERS FOR MLBW FORMULA (BELOW 12 KEV)
      RESONANCE PARAMETERS ADOPTED IN JENDL-3.1 WERE TAKEN FROM
    JENDL-2/3/:  RESONANCE ENERGIES WERE TAKEN FROM TELLIER/4/
    AND MUSGROVE ET AL./5/ BY ADJUSTING TO THOSE OF REF./4/.
    NEUTRON WIDTHS WERE TAKEN FROM REF./4/, AND RADIATION WIDTHS
    WERE DEDUCED FROM THE CAPTURE AREAS OF MUSGROVE ET AL.  FOR
    THE RESONANCES NOT MEASURED BY TELLIER, NEUTRON WIDTHS WERE
    ESTIMATED FROM THE CAPTURE AREAS BY ASSUMING THE AVERAGE
    RADIATION WIDTHS OF 0.047 EV FOR S-WAVE RESONANCES AND OF
    0.041 EV FOR P-WAVE ONES.  FOR THE LOWEST 2 LEVELS, THE
    CAPTURE WIDTHS OF KARZHAVINA ET AL./6/ WERE ADOPTED.  A
    NEGATIVE RESONANCE WAS ADDED AT -76 EV SO AS TO REPRODUCE THE
    CAPTURE CROSS SECTION OF 3.8+-0.3 BARNS AT 0.0253 EV /7/.
      FOR JENDL-3.2, THE CAPTURE DATA MEASURED AT ORELA OF ORNL
    WERE RENORMALIZED (FACTOR = 0.967)/8/.  THE NEUTRON WIDTH
    AND/OR THE RADIATION WIDTH WAS REVISED TO REPRODUCE THE
    RENORMALIZED CAPTURE AREA FOR EACH RESONANCE ABOVE 2.6 KEV.
    EFFECTIVE SCATTERING RADIUS RECOMMENDED IN REF./9/ WAS
    ADOPTED AND PARAMETERS OF THE NAGATIVE LEVEL WERE ADJUSTED TO
    THERMAL CROSS SECTIONS/9/.

  UNRESOLVED RESONANCE REGION : 12 KEV - 100 KEV
    UNRESOLVED RESONANCE PARAMETERS WERE ADOPTED FROM JENDL-2.
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/10/.  THE OBSERVED LEVEL
    SPACING WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 2.928E-4, S1 = 0.688E-4, S2 = 3.543E-4, SG = 0.998E-4,
    GG = 0.041 EV, R  = 7.660 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                      2200 M/S               RES. INTEG.
      TOTAL           4.6036                    -
      ELASTIC         1.0007                    -
      CAPTURE         3.6030                   4.30

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/11/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED BY IIJIMA AND KAWAI/12/ TO REPRODUCE A SYSTEMATIC
  TREND OF THE TOTAL CROSS SECTION.  THE OMP'S FOR CHARGED
  PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/13/
     ALPHA    = HUIZENGA AND IGO/14/
     DEUTERON = LOHR AND HAEBERLI/15/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/16/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/17/ WERE EVALUATED BY IIJIMA ET AL./18/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /19/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.
```

MT = 2 ELASTIC SCATTERING
CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

MT = 4, 51 - 91 INELASTIC SCATTERING
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS ADOPTED. THE LEVEL SCHEME WAS TAKEN FROM REF./20/.

NO.	ENERGY(MEV)	SPIN-PARITY	DWBA CAL.
GR.	0.0	0 +	
1	0.6965	2 +	*
2	1.3147	4 +	
3	1.5106	3 -	*
4	1.5610	2 +	
5	1.7913	6 +	

LEVELS ABOVE 1.817 MEV WERE ASSUMED TO BE OVERLAPPING.

FOR THE LEVELS WITH AN ASTERISK, THE CONTRIBUTION OF DIRECT INELASTIC SCATTERING CROSS SECTIONS WAS CALCULATED BY THE DWUCK-4 CODE/21/. DEFORMATION PARAMETER (BETA2 = 0.1309) WAS BASED ON THE DATA COMPILED BY RAMAN ET AL./22/ AND BETA3 = 0.143 WAS PRESENTLY DETERMINED.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/23/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (9.12E-05) WAS ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION OF 70 MILLI-BARNS AT 30 KEV MEASURED BY MUSGROVE ET AL./24/ AND BY KONONOV ET AL. /25/

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT = 32 (N,N'D) CROSS SECTION
MT = 33 (N,N'T) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =106 (N,HE3) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 25.0) WAS DETERMINED TO REPRODUCE ENERGY DEPENDENCE OF THE (N,2N) CROSS SECTION MEASURED BY FREHAUT ET AL./26/.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,P)	12.00 MB	(RECOMMENDED BY FORREST/27/)
(N,ALPHA)	5.40 MB	(AVERAGE OF DATA MEASURED BY GMUCA+/28/ AND QAIM/29/.

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. CONTRIBUTION OF DIRECT INELASTIC SCATTERING WAS CALCULATED WITH DWUCK-4. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 47.94	R0 = 6.718	A0 = 0.6
WS = 9.13	RS = 7.564	AS = 0.45
VSO= 7.0	RSO= 6.771	ASO= 0.6

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
58-CE-140	1.413E+01	6.541E-01	3.376E-01	5.852E+00	2.020E+00
58-CE-141	1.714E+01	5.150E-01	7.134E-01	3.957E+00	1.170E+00
58-CE-142	1.600E+01	6.000E-01	4.210E-01	5.674E+00	1.930E+00
58-CE-143	1.900E+01	5.500E-01	2.613E+00	5.094E+00	1.170E+00
59-PR-141	1.400E+01	6.500E-01	1.810E+00	4.559E+00	8.500E-01
59-PR-142	1.595E+01	6.150E-01	1.201E+01	3.974E+00	0.0
59-PR-143	1.500E+01	6.280E-01	2.607E+00	4.558E+00	7.600E-01
59-PR-144	1.600E+01	6.000E-01	1.045E+01	3.744E+00	0.0
60-ND-142	1.288E+01	6.710E-01	2.250E-01	5.526E+00	2.030E+00
60-ND-143	1.826E+01	4.710E-01	5.220E-01	3.613E+00	1.180E+00
60-ND-144	1.771E+01	5.640E-01	4.792E-01	5.691E+00	1.940E+00
60-ND-145	2.054E+01	5.120E-01	2.465E+00	4.869E+00	1.180E+00

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 8.725 FOR ND-144 AND 6.875 FOR ND-145.

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MAT number = 6034
 60-ND-145 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-SEP90 REV2-NOV94
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.
93-10 JENDL-3.2 WAS MADE BY JNDC FPND W.G.
94-11 UPPER BOUNDARY OF THE RESOLVED RESONANCE REGION CHANGED
      FROM 5.10069 KEV TO 4.0 KEV

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)       RESOLVED RESONANCE PARAMETERS
     ***********************************************************


MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 4 KEV
       RESONANCE PARAMETERS WERE TAKEN FROM JENDL-2/3/ WITH
    MODIFICATION OF TOTAL SPIN J.
       FOR JENDL-2, RESONANCE ENERGIES WERE TAKEN FROM TELLIER
    /4/, AND AFTER CALIBRATION, DATA OF ROHR ET AL./5/ AND
    MUSGROVE ET AL./6/ WERE ADOPTED FOR THE LEVELS NOT MEASURED BY
    TELLIER.  NEUTRON WIDTHS WERE ADOPTED FROM TELLIER, AND RADIA-
    TION WIDTHS WERE OBTAINED FROM THE CAPTURE AREAS MEASURED BY
    ROHR ET AL. AND MUSGROVE ET AL.  THE AVERAGE RADIATION WIDTH
    OF 0.087 EV WAS ASSUMED FOR THE RESONANCES WHOSE CAPTURE AREA
    WAS NOT MEASURED, AND TO ESTIMATE NEUTRON WIDTHS FROM THE
    CAPTURE AREAS FOR THE RESONANCES NOT MEASURED BY TELLIER.  A
    NEGATIVE RESONANCE WAS ADDED SO AS TO REPRODUCE THE THERMAL
    CAPTURE AND TOTAL CROSS SECTIONS GIVEN BY MUGHABGHAB ET AL./7/
       FOR JENDL-3, TOTAL SPIN J OF SOME RESONANCES WAS TENTATIVE-
    LY ESTIMATED WITH A RANDOM NUMBER METHOD.
       FOR JENDL-3.2, THE CAPTURE DATA MEASURED AT ORELA OF ORNL
    WERE RENORMALIZED (FACTOR = 0.9507)/8/.  THE NEUTRON WIDTH
    AND/OR THE RADIATION WIDTH WAS REVISED TO REPRODUCE THE
    RENORMALIZED CAPTURE AREA FOR EACH RESONANCE ABOVE 2.592 KEV.

  UNRESOLVED RESONANCE REGION : 4 KEV - 100 KEV
    UNRESOLVED RESONANCE PARAMETERS WERE ADOPTED FROM JENDL-2.
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/9/.  THE OBSERVED LEVEL
    SPACING WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION
    AT 100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 2.927E-4, S1 = 0.685E-4, S2 = 3.510E-4, SG = 54.7E-4,
    GG = 0.0975EV, R  = 7.683 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S                RES. INTEG.
      TOTAL          64.065                     -
      ELASTIC        20.222                     -
      CAPTURE        43.843                   204
     (N,ALPHA)        8.855E-05                  2.03E-3

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/10/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED BY IIJIMA AND KAWAI/11/ TO REPRODUCE A SYSTEMATIC
  TREND OF THE TOTAL CROSS SECTION.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/12/
     ALPHA    = HUIZENGA AND IGO/13/
     DEUTERON = LOHR AND HAEBERLI/14/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/15/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/16/ WERE EVALUATED BY IIJIMA ET AL./17/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /18/.
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MT = 1  TOTAL
  SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

MT = 2  ELASTIC SCATTERING
  CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

MT = 4, 51 - 91  INELASTIC SCATTERING
  SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
  ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./19/.

         NO.      ENERGY(MEV)    SPIN-PARITY
         GR.        0.0            7/2 -
          1         0.0671         3/2 -
          2         0.0722         5/2 -
          3         0.5066         3/2 -
          4         0.6570        11/2 -
          5         0.7490         9/2 -
          6         0.7804         3/2 -
          7         0.8407         3/2 -
          8         0.9202         1/2 -
          9         0.9371         5/2 -
         10         1.0112        11/2 -
         11         1.0514         7/2 -
         12         1.0852         3/2 +
         13         1.1503         9/2 -
         14         1.1610         5/2 -
         15         1.1620         9/2 -
         16         1.2500         5/2 -
    LEVELS ABOVE 1.3 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102  CAPTURE
  SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
  CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
  SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
  AND REFFO/20/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

  THE GAMMA-RAY STRENGTH FUNCTION (5.58E-03) WAS ADJUSTED TO
  REPRODUCE THE CAPTURE CROSS SECTION OF 510 MILLI-BARNS AT 30
  KEV MEASURED BY NAKAJIMA ET AL./21/

MT = 16  (N,2N) CROSS SECTION
MT = 17  (N,3N) CROSS SECTION
MT = 22  (N,N'A) CROSS SECTION
MT = 28  (N,N'P) CROSS SECTION
MT = 32  (N,N'D) CROSS SECTION
MT = 33  (N,N'T) CROSS SECTION
MT =103  (N,P) CROSS SECTION
MT =104  (N,D) CROSS SECTION
MT =105  (N,T) CROSS SECTION
MT =107  (N,ALPHA) CROSS SECTION
  THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
  PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

  THE KALBACH'S CONSTANT K (= 168.3) WAS ESTIMATED BY THE
  FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/22/ AND LEVEL
  DENSITY PARAMETERS.

  FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
  NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
    (N,P)           7.50  MB (RECOMMENDED BY FORREST/23/)
    (N,ALPHA)       2.47  MB (SYSTEMATICS OF FORREST/23/)

  THE (N,ALPHA) CROSS SECTION BELOW 4 KEV WAS CALCULATED FROM
  RESONANCE PARAMETERS, BY ASSUMING A MEAN ALPHA WIDTH OF
  1.50E-7 EV SO AS TO REPRODUCE THE THERMAL CROSS SECTION/7/.
  THE CROSS SECTION WAS AVERAGED IN SUITABLE ENERGY INTERVALS.
  ABOVE 4 KEV, THE CROSS SECTION WAS CONNECTED SMOOTHLY TO THE
  PEGASUS CALCULATION.

MT = 251  MU-BAR
  CALCULATED WITH CASTHY/9/.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
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PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

	DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
	V = 47.94	R0 = 6.718	A0 = 0.6
	WS = 9.13	RS = 7.564	AS = 0.45
	VSO= 7.0	RSO= 6.771	ASO= 0.6

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
58-CE-141		1.714E+01	5.150E-01	7.134E-01	3.957E+00	1.170E+00
58-CE-142		1.600E+01	6.000E-01	4.210E-01	5.674E+00	1.930E+00
58-CE-143		1.900E+01	5.500E-01	2.613E+00	5.094E+00	1.170E+00
58-CE-144		1.700E+01	6.000E-01	5.074E-01	6.214E+00	2.090E+00
59-PR-142		1.595E+01	6.150E-01	1.201E+01	3.974E+00	0.0
59-PR-143		1.500E+01	6.280E-01	2.607E+00	4.558E+00	7.600E-01
59-PR-144		1.600E+01	6.000E-01	1.045E+01	3.744E+00	0.0
59-PR-145	*	2.088E+01	5.411E-01	7.911E+00	5.258E+00	9.200E-01
60-ND-143		1.826E+01	4.710E-01	5.220E-01	3.613E+00	1.180E+00
60-ND-144		1.771E+01	5.640E-01	4.792E-01	5.691E+00	1.940E+00
60-ND-145		2.054E+01	5.120E-01	2.465E+00	4.869E+00	1.180E+00
60-ND-146		2.019E+01	5.660E-01	1.121E+00	6.714E+00	2.100E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 6.875 FOR ND-145 AND 6.125 FOR ND-146.

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MAT number = 6037

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 60-ND-146 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE PARAMETERS FOR MLBW FORMULA (BELOW 10 KEV)
    RESONANCE PARAMETERS WERE TAKEN FROM JENDL-2/3/.
       RESONANCE ENERGIES WERE TAKEN FROM TELLIER/4/ AND MUSGROVE
    ET AL./5/  NEUTRON WIDTHS WERE ADOPTED FROM TELLIER, AND
    RADIATION WIDTHS WERE DEDUCED FROM CAPTURE AREAS MEASURED BY
    MUSGROVE ET AL.  THE AVERAGE RADIATION WIDTHS WERE ASSUMED TO
    BE 0.051 EV FOR S-WAVE RESONANCES AND 0.040 EV FOR P-WAVE
    ONES.  A NEGATIVE RESONANCE WAS ADDED SO AS TO REPRODUCE THE
    CAPTURE CROSS SECTION OF 1.4+-0.1 BARNS AT 0.0253 EV/6/.

  UNRESOLVED RESONANCE REGION : 10 KEV - 100 KEV
    UNRESOLVED RESONANCE PARAMETERS WERE ADOPTED FROM JENDL-2.
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/7/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 2.927E-4, S1 = 0.682E-4, S2 = 3.479E-4, SG = 2.13E-4,
    GG = 0.051 EV, R  = 7.701 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL         10.90                     -
      ELASTIC        9.496                    -
      CAPTURE        1.399                     2.91

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/8/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED BY IIJIMA AND KAWAI/9/ TO REPRODUCE A SYSTEMATIC
  TREND OF THE TOTAL CROSS SECTION.  THE OMP'S FOR CHARGED
  PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/10/
     ALPHA    = HUIZENGA AND IGO/11/
     DEUTERON = LOHR AND HAEBERLI/12/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/13/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/14/ WERE EVALUATED BY IIJIMA ET AL./15/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /16/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./17/.

           NO.      ENERGY(MEV)    SPIN-PARITY    DWBA CAL.
           GR.      0.0             0  +
            1       0.4538          2  +             *
            2       1.0434          4  +
            3       1.1896          3  -             *
            4       1.3728          1  -
            5       1.4714          2  +
            6       1.5150          5  -
            7       1.5384          3  +
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8	1.6870	0 +
9	1.7510	4 +

LEVELS ABOVE 1.777 MEV WERE ASSUMED TO BE OVERLAPPING.

FOR THE LEVELS WITH AN ASTERISK, THE CONTRIBUTION OF DIRECT INELASTIC SCATTERING CROSS SECTIONS WAS CALCULATED BY THE DWUCK-4 CODE/18/. DEFORMATION PARAMETERS (BETA2 = 0.1524 AND BETA3 = 0.139) WERE BASED ON THE DATA COMPILED BY RAMAN ET AL./19/ AND SPEAR/20/, RESPECTIVELY.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/21/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (1.92E-04) WAS ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION OF 114 MILLI-BARNS AT 30 KEV MEASURED BY NAKAJIMA ET AL./22/

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT = 32 (N,N'D) CROSS SECTION
MT = 33 (N,N'T) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 12.5) WAS DETERMINED TO REPRODUCE ENERGY DEPENDENCE OF THE (N,2N) CROSS SECTION MEASURED BY FREHAUT ET AL./23/

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
(N,P) 4.50 MB (RECOMMENDED BY FORREST/24/)
(N,ALPHA) 3.10 MB (RECOMMENDED BY FORREST)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. CONTRIBUTION OF DIRECT INELASTIC SCATTERING WAS CALCULATED WITH DWUCK-4. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 47.94	R0 = 6.718	A0 = 0.6
WS = 9.13	RS = 7.564	AS = 0.45
VSO= 7.0	RSO= 6.771	ASO= 0.6

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
58-CE-142		1.600E+01	6.000E-01	4.210E-01	5.674E+00	1.930E+00
58-CE-143		1.900E+01	5.500E-01	2.613E+00	5.094E+00	1.170E+00
58-CE-144		1.700E+01	6.000E-01	5.074E-01	6.214E+00	2.090E+00
58-CE-145		2.100E+01	5.500E-01	6.213E+00	5.723E+00	1.170E+00
59-PR-143		1.500E+01	6.280E-01	2.607E+00	4.558E+00	7.600E-01
59-PR-144		1.600E+01	6.000E-01	1.045E+01	3.744E+00	0.0
59-PR-145	*	2.088E+01	5.411E-01	7.911E+00	5.258E+00	9.200E-01
59-PR-146	*	2.263E+01	5.387E-01	8.918E+01	4.815E+00	0.0
60-ND-144		1.771E+01	5.640E-01	4.792E-01	5.691E+00	1.940E+00

60-ND-145	2.054E+01	5.120E-01	2.465E+00	4.869E+00	1.180E+00
60-ND-146	2.019E+01	5.660E-01	1.121E+00	6.714E+00	2.100E+00
60-ND-147	2.398E+01	4.850E-01	5.510E+00	5.235E+00	1.180E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 6.125 FOR ND-146 AND 4.041 FOR ND-147.

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MAT number = 6040

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 60-ND-147 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 36 EV
      RESONANCE ENERGIES WERE BASED ON THE DATA OF REF./2/.
    NEUTRON WIDTHS WERE DERIVED FROM THE DATA OF 2*G*GAMMA(N) AND
    THE TOTAL SPIN J WHICH WAS ASSUMED TO BE 3 FOR ALL THE
    RESONANCES.  AVERAGE RADIATION WIDTH WAS ASSUMED TO BE 0.075
    EV/2/.  THE SCATTERING RADIUS WAS TAKEN FROM THE SYSTEMATICS
    SHOWN IN REF./2/.
      A NEGATIVE RESONANCE WAS ADDED SO AS TO REPRODUCE THE
    THERMAL CAPTURE CROSS SECTION GIVEN BY MUGHABGHAB ET AL./2/

  UNRESOLVED RESONANCE REGION : 0.036 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/3/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.  THE RADIATION WIDTH GG WAS BASED ON THE COMPILATION
    OF MUGHABGHAB ET AL.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 2.900E-4, S1 = 0.680E-4, S2 = 3.400E-4, SG = 159.E-4,
    GG = 0.075 EV, R  = 7.717 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S                RES. INTEG.
      TOTAL         510.3                       -
      ELASTIC        79.28                      -
      CAPTURE       431.0                      631

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/4/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED BY IIJIMA AND KAWAI/5/ TO REPRODUCE A SYSTEMATIC
  TREND OF THE TOTAL CROSS SECTION.  THE OMP'S FOR CHARGED
  PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/6/
     ALPHA    = HUIZENGA AND IGO/7/
     DEUTERON = LOHR AND HAEBERLI/8/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/9/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/10/ WERE EVALUATED BY IIJIMA ET AL./11/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /12/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/13/ AND NUCLEAR DATA
    SHEETS/14/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0            5/2 -
            1        0.0499         7/2 -
            2        0.1279         5/2 -
            3        0.1903         9/2 -
            4        0.2146         1/2 -
            5        0.3147         3/2 -
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            6        0.4636         3/2 -
            7        0.5167         5/2 -
            8        0.5750         7/2 -
            9        0.6045         1/2 -
           10        0.6315         3/2 -
           11        0.7693         3/2 +
           12        0.7926         3/2 -
      LEVELS ABOVE 0.809 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/15/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (1.50E-02) WAS DETERMINED FROM
    THE RADIATION WIDTH (0.075 EV) AND AVERAGE S-WAVE RESONANCE
    LEVEL SPACING (5+-2 EV) /2/.

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT = 32  (N,N'D) CROSS SECTION
  MT = 33  (N,N'T) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (= 109.9) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/16/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,P)          3.59  MB (SYSTEMATICS OF  FORREST/17/)
      (N,ALPHA)      1.54  MB (SYSTEMATICS OF  FORREST)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
         ----------------------   ------------  ---------------
         V  = 47.94               R0 = 6.718    A0 = 0.6
         WS = 9.13                RS = 7.564    AS = 0.45
         VSO= 7.0                 RSO= 6.771    ASO= 0.6
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2  LEVEL DENSITY PARAMETERS

 NUCLIDE  SYST A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
 ---------------------------------------------------------------
 58-CE-143      1.900E+01 5.500E-01 2.613E+00 5.094E+00 1.170E+00
 58-CE-144      1.700E+01 6.000E-01 5.074E-01 6.214E+00 2.090E+00
 58-CE-145      2.100E+01 5.500E-01 6.213E+00 5.723E+00 1.170E+00
 58-CE-146      1.918E+01 6.037E-01 1.355E+00 7.176E+00 2.160E+00

 59-PR-144      1.600E+01 6.000E-01 1.045E+01 3.744E+00 0.0
 59-PR-145   *  2.088E+01 5.411E-01 7.911E+00 5.258E+00 9.200E-01
 59-PR-146   *  2.263E+01 5.387E-01 8.918E+01 4.815E+00 0.0
 59-PR-147      2.440E+01 4.420E-01 3.742E+00 4.298E+00 9.900E-01

 60-ND-145      2.054E+01 5.120E-01 2.465E+00 4.869E+00 1.180E+00
 60-ND-146      2.019E+01 5.660E-01 1.121E+00 6.714E+00 2.100E+00
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 60-ND-147      2.398E+01 4.850E-01 5.510E+00 5.235E+00 1.180E+00
 60-ND-148      2.359E+01 5.150E-01 1.328E+00 6.751E+00 2.170E+00
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  SYST:  * = LDP'S WERE DETERMINED FROM SYSTEMATICS.
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SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 4.041 FOR ND-147 AND 4.791 FOR ND-148.

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MAT number = 6043

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 60-ND-148 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE PARAMETERS FOR MLBW FORMULA (BELOW 8.0 KEV)
    RESONANCE PARAMETERS WERE TAKEN FROM JENDL-2/3/.
      RESONANCE ENERGIES WERE TAKEN FROM TELLIER/4/ AND MUSGROVE
    ET AL./5/  NEUTRON WIDTHS WERE ADOPTED FROM TELLIER, AND
    RADIATION WIDTHS WERE DEDUCED FROM CAPTURE AREAS MEASURED BY
    MUSGROVE ET AL.  THE AVERAGE RADIATION WIDTHS WERE ASSUMED TO
    BE 0.046 EV FOR S-WAVE RESONANCES AND 0.040 EV FOR P-WAVE
    ONES.  A NEGATIVE RESONANCE WAS ADDED SO AS TO REPRODUCE THE
    CAPTURE CROSS SECTION OF 2.5+-0.2 BARNS AT 0.0253 EV/6/.

  UNRESOLVED RESONANCE REGION : 8 KEV - 100 KEV
    UNRESOLVED RESONANCE PARAMETERS WERE ADOPTED FROM JENDL-2.
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/7/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 2.927E-4, S1 = 0.676E-4, S2 = 3.417E-4, SG = 2.16E-4,
    GG = 0.041 EV, R  = 7.703 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           6.997                   -
      ELASTIC         4.505                   -
      CAPTURE         2.493                  14.7

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/8/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED BY IIJIMA AND KAWAI/9/ TO REPRODUCE A SYSTEMATIC
  TREND OF THE TOTAL CROSS SECTION.  THE OMP'S FOR CHARGED
  PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/10/
     ALPHA    = HUIZENGA AND IGO/11/
     DEUTERON = LOHR AND HAEBERLI/12/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/13/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/14/ WERE EVALUATED BY IIJIMA ET AL./15/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /16/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./17/.

           NO.      ENERGY(MEV)    SPIN-PARITY    DWBA CAL.
           GR.       0.0             0  +
            1        0.3020          2  +             *
            2        0.7510          4  +
            3        0.9110          0  +
            4        0.9970          3  -             *
            5        1.0200          1  -
            6        1.1690          2  +
            7        1.2410          2  +
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8	1.6830	4	+
9	1.7240	3	-

LEVELS ABOVE 1.8 MEV WERE ASSUMED TO BE OVERLAPPING.

FOR THE LEVELS WITH AN ASTERISK, THE CONTRIBUTION OF DIRECT INELASTIC SCATTERING CROSS SECTIONS WAS CALCULATED BY THE DWUCK-4 CODE/18/. DEFORMATION PARAMETERS (BETA2 = 0.2036 AND BETA3 = 0.098) WERE BASED ON THE DATA COMPILED BY RAMAN ET AL./19/ AND SPEAR/20/, RESPECTIVELY.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/21/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (1.94E-4) WAS ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION OF 100 MILLI-BARNS AT 50 KEV MEASURED BY CRICCHIO ET AL./22/

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT = 32 (N,N'D) CROSS SECTION
MT = 33 (N,N'T) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 10.0) WAS DETERMINED TO REPRODUCE ENERGY DEPENDENCE OF THE (N,2N) CROSS SECTION MEASURED BY FREHAUT ET AL./23/.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,P)	2.75 MB	(SYSTEMATICS OF FORREST/24/)
(N,ALPHA)	2.40 MB	(RECOMMENDED BY FORREST/24/)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. CONTRIBUTION OF DIRECT INELASTIC SCATTERING WAS CALCULATED WITH DWUCK-4. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 47.94	R0 = 6.718	A0 = 0.6
WS = 9.13	RS = 7.564	AS = 0.45
VSO= 7.0	RSO= 6.771	ASO= 0.6

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
58-CE-144		1.700E+01	6.000E-01	5.074E-01	6.214E+00	2.090E+00
58-CE-145		2.100E+01	5.500E-01	6.213E+00	5.723E+00	1.170E+00
58-CE-146		1.918E+01	6.037E-01	1.355E+00	7.176E+00	2.160E+00
58-CE-147	*	2.514E+01	5.363E-01	2.925E+01	6.672E+00	1.170E+00
59-PR-145	*	2.088E+01	5.411E-01	7.911E+00	5.258E+00	9.200E-01
59-PR-146	*	2.263E+01	5.387E-01	8.918E+01	4.815E+00	0.0
59-PR-147		2.440E+01	4.420E-01	3.742E+00	4.298E+00	9.900E-01
59-PR-148		1.996E+01	4.690E-01	1.108E+01	2.807E+00	0.0
60-ND-146		2.019E+01	5.660E-01	1.121E+00	6.714E+00	2.100E+00

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60-ND-147     2.398E+01 4.850E-01 5.510E+00 5.235E+00 1.180E+00
60-ND-148     2.359E+01 5.150E-01 1.328E+00 6.751E+00 2.170E+00
60-ND-149     2.657E+01 4.750E-01 1.192E+01 5.636E+00 1.180E+00
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 SYST:  * = LDP'S WERE DETERMINED FROM SYSTEMATICS.
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SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 4.791 FOR ND-148 AND 5.0 FOR ND-149.

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MAT number = 6049

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 60-ND-150 JNDC         EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                        DIST-SEP90 REV2-OCT93
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.
93-10 MODIFICATION FOR JENDL-3.2 WAS MADE.
      CONTRIBUTION OF THE DIRECT INELASTIC SCATTERING WAS
      REPLACED BY A COUPLED-CHANNEL CALCULATION.

**** MODIFIED PARTS FOR JENDL-3.2 ********************************
(3,2),(3,4),(3,51),(3,52),(3,54),(3,56),(3,58)
(4,51),(4,52),(4,54),(4,56),(4,58)
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MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE PARAMETERS FOR MLBW FORMULA (BELOW 13.69 KEV)
    RESONANCE PARAMETERS WERE TAKEN FROM JENDL-2/3/.
      NEUTRON WIDTHS WERE ADOPTED FROM TELLIER/4/.  RADIATION
    WIDTHS WERE TAKEN FROM THE RECOMMENDATION BY MAGHABGHAB AND
    GARBER/5/. THE AVERAGE RADIATION WIDTH OF 0.070 EV WAS ASSUMED
    FOR LEVELS WHICH HAD NO MEASURED RADIATION WIDTH.  A NEGATIVE
    RESONANCE WAS ADDED SO AS TO REPRODUCE THE CAPTURE CROSS
    SECTION OF 1.2+-0.2 BARNS AT 0.0253 EV /6/.

  UNRESOLVED RESONANCE REGION : 13.69 KEV - 100 KEV
    UNRESOLVED RESONANCE PARAMETERS WERE ADOPTED FROM JENDL-2.
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/7/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 2.600E-4, S1 = 0.667E-4, S2 = 3.500E-4, SG = 3.39E-4,
    GG = 0.037 EV, R  = 7.993 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           5.982                   -
      ELASTIC         4.780                   -
      CAPTURE         1.202                  15.9

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/8/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED BY IIJIMA AND KAWAI/9/ TO REPRODUCE A SYSTEMATIC
  TREND OF THE TOTAL CROSS SECTION.  THE OMP'S FOR CHARGED
  PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/10/
     ALPHA    = HUIZENGA AND IGO/11/
     DEUTERON = LOHR AND HAEBERLI/12/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/13/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/14/ WERE EVALUATED BY IIJIMA ET AL./15/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /16/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./17/.

           NO.      ENERGY(MEV)    SPIN-PARITY    CC CAL.
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          GR.       0.0             0  +
           1        0.1301          2  +          *
           2        0.3815          4  +          *
           3        0.6767          0  +
           4        0.7212          6  +          *
           5        0.8514          2  +
           6        0.9300          3  -          *
           7        1.0624          2  +
           8        1.1307          8  +          *
           9        1.1386          4  +
          10        1.3535          4  +
     LEVELS ABOVE 1.45 MEV WERE ASSUMED TO BE OVERLAPPING.

       FOR THE LEVELS WITH AN ASTERISK, THE CONTRIBUTION OF DIRECT
       INELASTIC SCATTERING CROSS SECTIONS WAS CALCULATED BY THE
       ECIS-88 CODE/18/.  DEFORMATION PARAMETERS (BETA2 = 0.2848 AND
       BETA3 = 0.070) WERE BASED ON THE DATA COMPILED BY RAMAN ET
       AL./19/ AND SPEAR/20/, RESPECTIVELY.  THE COUPLING OF G.S.
       ROTATIONAL BAND (0+,2+,4+,6+,8+,10+) AND OCTUPOLE VIBRATIONAL
       BAND (1-,3-,5-) WAS CONSIDERED.  IN THE CC CALCULATION, THE
       IMAGINARY SURFACE STRENGTH WAS REDUVED TO 7.35 MEV.

     MT = 102  CAPTURE
       SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
       CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
       SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
       AND REFFO/21/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

       THE GAMMA-RAY STRENGTH FUNCTION (3.01E-04) WAS ADJUSTED TO
       REPRODUCE THE CAPTURE CROSS SECTION OF 153 MILLI-BARNS AT 30
       KEV MEASURED BY KONONOV ET AL./22/

     MT = 16  (N,2N) CROSS SECTION
     MT = 17  (N,3N) CROSS SECTION
     MT = 22  (N,N'A) CROSS SECTION
     MT = 28  (N,N'P) CROSS SECTION
     MT = 32  (N,N'D) CROSS SECTION
     MT = 33  (N,N'T) CROSS SECTION
     MT =103  (N,P) CROSS SECTION
     MT =104  (N,D) CROSS SECTION
     MT =105  (N,T) CROSS SECTION
     MT =107  (N,ALPHA) CROSS SECTION
       THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
       PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

       THE KALBACH'S CONSTANT K (=  10.0) WAS DETERMINED TO REPRODUCE
       ENERGY DEPENDENCE OF THE (N,2N) CROSS SECTION MEASURED BY
       FREHAUT ET AL./23/

       FINALLY, THE (N,P) CROSS SECTION WAS NORMALIZED TO THE
       FOLLOWING VALUE AT 14.5 MEV:
         (N,P)          1.61  MB (SYSTEMATICS OF FORREST/24/)
       THE (N,2N) CROSS SECTION WAS DETERMINED BY EYE-GUIDING OF
       THE DATA MEASURED BY FREHAUT ET AL./23/

     MT = 251  MU-BAR
       CALCULATED WITH CASTHY.

   MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
     LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
     GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
     TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
     CALCULATED WITH CASTHY.  CONTRIBUTION OF DIRECT INELASTIC
     SCATTERING WAS CALCULATED WITH ECIS-88.  FOR OTHER REACTIONS,
     ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

   MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
     ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
     PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
     OTHER NEUTRON EMITTING REACTIONS.

   TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                   DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
             ----------------------  ------------  ---------------
           V  = 47.94                R0 = 6.748    A0 = 0.6
           WS = 9.13                 RS = 7.598    AS = 0.45
           VSO= 7.0                  RSO= 6.801    ASO= 0.6
     THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

   TABLE 2  LEVEL DENSITY PARAMETERS
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NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
58-CE-146		1.918E+01	6.037E-01	1.355E+00	7.176E+00	2.160E+00
58-CE-147	*	2.514E+01	5.363E-01	2.925E+01	6.672E+00	1.170E+00
58-CE-148	*	2.454E+01	5.338E-01	2.640E+00	7.549E+00	2.280E+00
58-CE-149	*	2.392E+01	5.314E-01	1.525E+01	6.206E+00	1.170E+00
59-PR-147		2.440E+01	4.420E-01	3.742E+00	4.298E+00	9.900E-01
59-PR-148		1.996E+01	4.690E-01	1.108E+01	2.807E+00	0.0
59-PR-149	*	2.470E+01	5.314E-01	2.403E+01	6.371E+00	1.110E+00
59-PR-150	*	2.408E+01	5.290E-01	1.412E+02	5.027E+00	0.0
60-ND-148		2.359E+01	5.150E-01	1.328E+00	6.751E+00	2.170E+00
60-ND-149		2.657E+01	4.750E-01	1.192E+01	5.636E+00	1.180E+00
60-ND-150		2.415E+01	5.280E-01	1.867E+00	7.314E+00	2.290E+00
60-ND-151		2.618E+01	4.800E-01	1.152E+01	5.656E+00	1.180E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 10.32 FOR ND-150 AND 5.0 FOR ND-151.

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MAT number = 6149

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 61-PM-147 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE PARAMETERS FOR MLBW FORMULA (BELOW 102 EV)
       FOR JENDL-3, THE EXISTING JENDL-2 DATA WERE ENTIRELY
    REPLACED BY NEW EVALUATION MENTIONED BELOW.  THE RADIATION
    WIDTHS AND NEUTRON WIDTHS WERE ADOPTED FROM REF./3/.  THE
    ORBITAL ANGULAR MOMENTUM L WAS ASSIGNED BY TAKING INTO
    ACCOUNT THE MAGNITUDE OF NEUTRON WIDTHS.  TOTAL SPIN J OF
    SOME RESONANCES WAS TENTATIVELY ESTIMATED WITH A RANDOM
    NUMBER METHOD.  SCATTERING RADIUS OF 8.21 FM WAS ESTIMETED
    FROM THE MEASURED VALUES FOR ADJACENT NUCLIDES/3/.  A
    NEGATIVE RESONANCE WAS ADDED SO AS TO REPRODUCE THE THERMAL
    CAPTURE AND ELASTIC SCATTERING CROSS SECTIONS GIVEN BY
    MUGHABGHAB/3/.

  UNRESOLVED RESONANCE REGION : 0.102 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTION S0 WAS BASED ON THE COMPILATION
    OF MUGHABGHAB /3/, AND S1 AND S2 WERE CALCULATED WITH OPTICAL
    MODEL CODE CASTHY/4/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH GG WAS BASED ON THE COMPILATION OF
    MUGHABGHAB.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 3.100E-4, S1 = 1.000E-4, S2 = 2.100E-4, SG = 145.E-4,
    GG = 0.068 EV, R  = 3.916 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                   2200 M/S               RES. INTEG.
      TOTAL       188.6                      -
      ELASTIC      20.91                     -
      CAPTURE     167.7                    2210

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/5/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  ADOPTED FROM MOLDAUER/6/ BECAUSE THEY REPRODUCED WELL A THE
  PM-147 TOTAL CROSS SECTION MEASURED BY FOSTER AND GLASGOW/7/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/8/
     ALPHA    = HUIZENGA AND IGO/9/
     DEUTERON = LOHR AND HAEBERLI/10/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/11/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/12/ WERE EVALUATED BY IIJIMA ET AL./13/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /14/.

  MT = 1  TOTAL
    BELOW 5 MEV, SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.
    ABOVE 5 MEV, AN EYE-GUIDED CURVE WAS DETERMINED ON THE BASIS
    OF EXPERIMENTAL DATA OF FOSTER AND GLASGOW/7/.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./15/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.        0.0           7/2 +
            1         0.0911        5/2 +
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2	0.4105	3/2 +
3	0.4893	5/2 +
4	0.5310	5/2 +
5	0.6800	7/2 +
6	0.6858	5/2 +

LEVELS ABOVE 0.7 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/16/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (1.40E-02) WAS DETERMINED FROM THE SYSTEMATICS OF RADIATION WIDTH (0.066 EV) AND AVERAGE S-WAVE RESONANCE LEVEL SPACING (4.7 EV).

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT = 32 (N,N'D) CROSS SECTION
MT = 33 (N,N'T) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =106 (N,HE3) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 130.6) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/17/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,P)	7.06 MB	(SYSTEMATICS OF FORREST/18/)
(N,ALPHA)	2.73 MB	(SYSTEMATICS OF FORREST)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 46.0	R0 = 6.722	A0 = 0.62
WS = 7.0	RS = 6.722	AS = 1.0
VSO= 7.0	RSO= 6.722	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS GAUSSIAN TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
59-PR-143		1.500E+01	6.280E-01	2.607E+00	4.558E+00	7.600E-01
59-PR-144		1.600E+01	6.000E-01	1.045E+01	3.744E+00	0.0
59-PR-145	*	2.088E+01	5.411E-01	7.911E+00	5.258E+00	9.200E-01
59-PR-146	*	2.263E+01	5.387E-01	8.918E+01	4.815E+00	0.0
60-ND-144		1.771E+01	5.640E-01	4.792E-01	5.691E+00	1.940E+00
60-ND-145		2.054E+01	5.120E-01	2.465E+00	4.869E+00	1.180E+00
60-ND-146		2.019E+01	5.660E-01	1.121E+00	6.714E+00	2.100E+00
60-ND-147		2.398E+01	4.850E-01	5.510E+00	5.235E+00	1.180E+00
61-PM-145	*	1.769E+01	5.411E-01	2.780E+00	4.120E+00	7.600E-01
61-PM-146	*	1.942E+01	5.387E-01	2.241E+01	3.849E+00	0.0
61-PM-147		2.192E+01	4.913E-01	4.801E+00	4.589E+00	9.200E-01
61-PM-148		2.227E+01	4.300E-01	1.420E+01	2.672E+00	0.0

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 SYST:  * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 4.666 FOR PM-147 AND 5.0 FOR PM-148.
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MAT number = 6152

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 61-PM-148 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  NO RESOLVED RESONANCE PARAMETERS

  UNRESOLVED RESONANCE REGION : 1.1 EV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/2/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.  THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS
    OF MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 3.200E-4, S1 = 0.960E-4, S2 = 2.230E-4, SG = 301.E-4,
    GG = 0.065 EV, R  = 4.015 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                   2200 M/S               RES. INTEG.
      TOTAL      2003                        -
      ELASTIC       3.100                    -
      CAPTURE    2000                      2510

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 1.1 EV, THE CAPTURE AND ELASTIC SCATTERING CROSS SECTIONS
  WERE ASSUMED TO BE IN 1/V FORM AND CONSTANT, RESPECTIVELY.  THE
  CAPTURE CROSS SECTION AT 0.0253 EV WAS TAKEN FROM REF./3/, AND
  THE ELASTIC SCATTERING CROSS SECTION WAS ESTIMATED BY ASSUMING
  R = 5.0 FM.  UNRESOLVED RESONANCE PARAMETERS WERE GIVEN IN THE
  ENERGY RANGE FROM 1.1 EV TO 100 KEV.

  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/4/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  ADOPTED FROM MOLDAUER/5/ BECAUSE THEY REPRODUCED WELL A THE
  PM-147 TOTAL CROSS SECTION MEASURED BY FOSTER AND GLASGOW/6/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/7/
     ALPHA    = HUIZENGA AND IGO/8/
     DEUTERON = LOHR AND HAEBERLI/9/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/10/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/11/ WERE EVALUATED BY IIJIMA ET AL./12/.  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /13/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/14/ AND NUCLEAR DATA
    SHEETS/15/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             1  -
            1        0.0757          2  -
            2        0.1370          6  -
      LEVELS ABOVE 0.2 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
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    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/16/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (2.90E-02) WAS DETERMINED FROM
    THE SYSTEMATICS OF RADIATION WIDTH (0.065 EV) AND THE AVERAGE
    S-WAVE RESONANCE LEVEL SPACING (2.24 EV) CALCULATED FROM THE
    LEVEL DENSITY PARAMETERS.

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT = 32  (N,N'D) CROSS SECTION
  MT = 33  (N,N'T) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =106  (N,HE3) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (= 109.6) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/17/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,P)           5.43  MB (SYSTEMATICS OF FORREST/18/)
      (N,ALPHA)       2.16  MB (SYSTEMATICS OF FORREST)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

              DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
         ----------------------  ------------  ---------------
        V  = 46.0               R0 = 6.736    A0 = 0.62
        WS = 7.0                RS = 6.736    AS = 1.0
        VSO= 7.0                RSO= 6.736    ASO= 0.62
  THE FORM OF SURFACE ABSORPTION PART IS GAUSSIAN TYPE.

TABLE 2  LEVEL DENSITY PARAMETERS

 NUCLIDE  SYST A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
 ---------------------------------------------------------------
 59-PR-144      1.600E+01 6.000E-01 1.045E+01 3.744E+00 0.0
 59-PR-145   *  2.088E+01 5.411E-01 7.911E+00 5.258E+00 9.200E-01
 59-PR-146   *  2.263E+01 5.387E-01 8.918E+01 4.815E+00 0.0
 59-PR-147      2.440E+01 4.420E-01 3.742E+00 4.298E+00 9.900E-01

 60-ND-145      2.054E+01 5.120E-01 2.465E+00 4.869E+00 1.180E+00
 60-ND-146      2.019E+01 5.660E-01 1.121E+00 6.714E+00 2.100E+00
 60-ND-147      2.398E+01 4.850E-01 5.510E+00 5.235E+00 1.180E+00
 60-ND-148      2.359E+01 5.150E-01 1.328E+00 6.751E+00 2.170E+00

 61-PM-146   *  1.942E+01 5.387E-01 2.241E+01 3.849E+00 0.0
 61-PM-147      2.192E+01 4.913E-01 4.801E+00 4.589E+00 9.200E-01
 61-PM-148      2.227E+01 4.300E-01 1.420E+01 2.672E+00 0.0
 61-PM-149      2.377E+01 4.890E-01 8.141E+00 5.075E+00 9.900E-01
 ---------------------------------------------------------------
  SYST:  * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

 SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
 IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
 ASSUMED TO BE 5.0 FOR PM-148 AND 6.071 FOR PM-149.

REFERENCES
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MAT number = 6153

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 61-PM-148MJNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (SLBW FORMULA) : BELOW 0.6 EV
    PARAMETERS OF A SINGLE RESONANCE AT 0.169 EV WERE ADOPTED FROM
    MUGHABGHAB/2/ ASSUMING TO BE S-WAVE RESONANCE AND TOTAL SPIN
    OF 6.5.

  UNRESOLVED RESONANCE REGION : 0.6 EV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0 AND S1 WERE CALCULATED WITH
    OPTICAL MODEL CODE CASTHY/3/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY.  IN ORDER TO GET REASONABLE LEVEL SPACING, THE
    RADIATION WIDTH GG WAS ASSUMED TO BE 0.08 EV WHICH WAS LARGER
    THAN 0.065 EV OBTAINED FROM THE SYSTEMATICS OF MEASURED
    VALUES.  EFFECTIVE SCATTERING RADIUS WAS OBTAINED FROM FITTING
    TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 3.652E-4, S1 = 1.141E-4, SG = 772.E-4, GG = 0.080 EV
    R  = 2.860 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                    2200 M/S                 RES. INTEG.
      TOTAL       10620                           -
      ELASTIC        19.14                        -
      CAPTURE     10600                         3590

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/4/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  ADOPTED FROM MOLDAUER/5/ BECAUSE THEY REPRODUCED WELL A THE
  PM-147 TOTAL CROSS SECTION MEASURED BY FOSTER AND GLASGOW/6/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/7/
     ALPHA    = HUIZENGA AND IGO/8/
     DEUTERON = LOHR AND HAEBERLI/9/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/10/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/11/ WERE EVALUATED BY IIJIMA ET AL./12/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /13/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/14/ AND NUCLEAR DATA
    SHEETS/15/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             6  -
            1       -0.1370          1  -
            2       -0.0613          2  -
      LEVELS ABOVE 0.063 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/16/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.
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THE GAMMA-RAY STRENGTH FUNCTION (8.44E-02) WAS DETERMINED FROM THE SYSTEMATICS OF RADIATION WIDTH (0.065 EV) AND THE AVERAGE S-WAVE RESONANCE LEVEL SPACING (0.770 EV) CALCULATED FROM THE LEVEL DENSITY PARAMETERS.

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT = 32 (N,N'D) CROSS SECTION
MT = 33 (N,N'T) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =106 (N,HE3) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION

THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 109.6) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/17/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,P)	5.43 MB	(SYSTEMATICS OF FORREST/18/)
(N,ALPHA)	2.16 MB	(SYSTEMATICS OF FORREST)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 46.0	R0 = 6.736	A0 = 0.62
WS = 7.0	RS = 6.736	AS = 1.0
VSO= 7.0	RSO= 6.736	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS GAUSSIAN TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
59-PR-144		1.600E+01	6.000E-01	1.045E+01	3.744E+00	0.0
59-PR-145	*	2.088E+01	5.411E-01	7.911E+00	5.258E+00	9.200E-01
59-PR-146	*	2.263E+01	5.387E-01	8.918E+01	4.815E+00	0.0
59-PR-147		2.440E+01	4.420E-01	3.742E+00	4.298E+00	9.900E-01
60-ND-145		2.054E+01	5.120E-01	2.465E+00	4.869E+00	1.180E+00
60-ND-146		2.019E+01	5.660E-01	1.121E+00	6.714E+00	2.100E+00
60-ND-147		2.398E+01	4.850E-01	5.510E+00	5.235E+00	1.180E+00
60-ND-148		2.359E+01	5.150E-01	1.328E+00	6.751E+00	2.170E+00
61-PM-146	*	1.942E+01	5.387E-01	2.241E+01	3.849E+00	0.0
61-PM-147		2.192E+01	4.913E-01	4.801E+00	4.589E+00	9.200E-01
61-PM-148		2.227E+01	4.300E-01	1.420E+01	2.672E+00	0.0
61-PM-149		2.377E+01	4.890E-01	8.141E+00	5.075E+00	9.900E-01

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 5.0 FOR PM-148 AND 6.071 FOR PM-149.

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MAT number = 6155

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 61-PM-149 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  NO RESOLVED RESONANCE PARAMETERS

  UNRESOLVED RESONANCE REGION : 2.6 EV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/2/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.  THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS
    OF MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 3.400E-4, S1 = 0.930E-4, S2 = 2.300E-4, SG = 137.E-4,
    GG = 0.068 EV, R  = 3.970 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                   2200 M/S               RES. INTEG.
      TOTAL       1403                      -
      ELASTIC        3.200                  -
      CAPTURE     1400                    1570

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 2.6 EV, THE CAPTURE AND ELASTIC SCATTERING CROSS SECTIONS
  WERE ASSUMED TO BE IN 1/V FORM AND CONSTANT, RESPECTIVELY.  THE
  CAPTURE CROSS SECTION AT 0.0253 EV WAS TAKEN FROM REF./3/, AND
  THE ELASTIC SCATTERING CROSS SECTION WAS ESTIMATED BY ASSUMING
  R = 5.0 FM.  UNRESOLVED RESONANCE PARAMETERS WERE GIVEN IN THE
  ENERGY RANGE FROM 2.6 EV TO 100 KEV.

  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/4/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  ADOPTED FROM MOLDAUER/5/, WHICH REPRODUCED WELL THE PM-147 TOTAL
  CROSS SECTION MEASURED BY FOSTER AND GLASGOW/6/.  THE OMP'S FOR
  CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/7/
     ALPHA    = HUIZENGA AND IGO/8/
     DEUTERON = LOHR AND HAEBERLI/9/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/10/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/11/ WERE EVALUATED BY IIJIMA ET AL./12/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /13/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/14/ AND NUCLEAR DATA
    SHEETS/15/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             7/2 +
            1        0.1143          5/2 +
            2        0.1886          5/2 +
            3        0.2113          5/2 +
            4        0.2402         11/2 -
            5        0.2702          7/2 -
            6        0.2882          5/2 +
            7        0.3600          5/2 +
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           8        0.3876         1/2 +
           9        0.3968         5/2 +
          10        0.4253         5/2 +
          11        0.4622         3/2 -
          12        0.5156         9/2 +
          13        0.5379         5/2 -
          14        0.6548         7/2 -
      LEVELS ABOVE 0.7 MEV WERE ASSUMED TO BE OVERLAPPING.
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MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/16/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (1.30E-02) WAS DETERMINED FROM THE SYSTEMATICS OF RADIATION WIDTH (0.068 EV) AND THE AVERAGE S-WAVE RESONANCE LEVEL SPACING (5.22 EV) CALCULATED FROM THE LEVEL DENSITY PARAMETERS.

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT = 32 (N,N'D) CROSS SECTION
MT = 33 (N,N'T) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 128.4) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/17/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

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  (N,P)          4.17  MB (SYSTEMATICS OF FORREST/18/)
  (N,ALPHA)      1.71  MB (SYSTEMATICS OF FORREST)
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MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

	DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
	V = 46.0	R0 = 6.75	A0 = 0.62
	WS = 7.0	RS = 6.75	AS = 1.0
	VSO= 7.0	RSO= 6.75	ASO= 0.62

THE FORM OF SURFACE ABSORPTION PART IS GAUSSIAN TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
59-PR-145	*	2.088E+01	5.411E-01	7.911E+00	5.258E+00	9.200E-01
59-PR-146	*	2.263E+01	5.387E-01	8.918E+01	4.815E+00	0.0
59-PR-147		2.440E+01	4.420E-01	3.742E+00	4.298E+00	9.900E-01
59-PR-148		1.996E+01	4.690E-01	1.108E+01	2.807E+00	0.0
60-ND-146		2.019E+01	5.660E-01	1.121E+00	6.714E+00	2.100E+00
60-ND-147		2.398E+01	4.850E-01	5.510E+00	5.235E+00	1.180E+00
60-ND-148		2.359E+01	5.150E-01	1.328E+00	6.751E+00	2.170E+00
60-ND-149		2.657E+01	4.750E-01	1.192E+01	5.636E+00	1.180E+00
61-PM-147		2.192E+01	4.913E-01	4.801E+00	4.589E+00	9.200E-01
61-PM-148		2.227E+01	4.300E-01	1.420E+01	2.672E+00	0.0

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 61-PM-149     2.377E+01 4.890E-01 8.141E+00 5.075E+00 9.900E-01
 61-PM-150     2.270E+01 3.800E-01 7.943E+00 1.973E+00 0.0
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  SYST:  * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

 SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
 IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
 ASSUMED TO BE 6.071 FOR PM-149 AND 5.0 FOR PM-150.
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MAT number = 6225
 62-SM-144 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-SEP90 REV2-NOV93
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/
93-11 JENDL-3.2 WAS MADE BY JNDC FPND W.G.

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)        RESOLVED RESONANCE PARAMETERS BASED ON A
                     RECENT EXPERIMENTAL REPORT.
      (3,1), (3,2), (3,4), (3,51-91), (3,102)
                     RENORMALIZATION OF CAPTURE AND RECALCU-
                     LATION OF DIRECT INELASTIC PROCESS.
      (4,51-91)
     ***********************************************************


MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
    THE RESOLVED RESONANCE PARAMETERS WERE EVALUATED ON THE BASIS
    OF THE DATA RECENTLY MEASURED BY MACKLIN ET AL./2/  FOR RESO-
    NANCES WHOSE NEUTRON WIDTH WAS NOT MEASURED, THE NEUTRON WIDTH
    WAS OBTAINED FROM THE CAPTURE AREA ASSUMING THE RADIATION
    WIDTH OF 0.074 EV AND 0.089 EV FOR THE S-WAVE AND P-WAVE RESO-
    NANCES, RESPECTIVELY.  FOR P-WAVE RESONANCES, THE VALUE OF THE
    TOTAL SPIN J WAS ARBITRARILY ASSIGNED WITH THE RATIO 1:2 IN
    THE NUMBER OF THE RESONANCES WITH J=1/2 AND J=3/2.  TO REPRO-
    DUCE THE THERMAL CROSS SECTION OF 1.64+-0.10 B AT 0.0253
    EV/3/, A NEGATIVE RESONANCE WAS ADDED AT 104 EV.  THE EFFEC-
    TIVE SCATTERING RADIUS WAS EMPLOYED FROM THE MEASURED DATA BY
    MACKLIN ET AL./2/

  UNRESOLVED RESONANCE REGION : 10 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTION S0 WAS BASED ON THE COMPILATION
    OF MUGHABGHAB/4/, AND S1 AND S2 WERE CALCULATED WITH OPTICAL
    MODEL CODE CASTHY/5/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS OF
    MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 3.200E-4, S1 = 1.900E-4, S2 = 2.000E-4, SG = 1.27E-4,
    GG = 0.060 EV, R  = 5.748 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                    2200 M/S                RES. INTEG.
      TOTAL          2.3992                    -
      ELASTIC        0.7588                    -
      CAPTURE        1.6404                   1.91

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/6/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE THE TOTAL CROSS SECTIONS OF NATURAL SM
  MEASURED BY FOSTER AND GLASGOW/7/, KELLIE ET AL./8/ AND SO
  ON.  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/9/
     ALPHA    = HUIZENGA AND IGO/10/
     DEUTERON = LOHR AND HAEBERLI/11/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/12/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/13/ WERE EVALUATED BY IIJIMA ET AL./14/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /15/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
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CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

MT = 4, 51 - 91 INELASTIC SCATTERING
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR STRUCTURE DATA FILE (1987 VERSION)/16/ AND NUCLEAR DATA SHEETS/17/.

NO.	ENERGY(MEV)	SPIN-PARITY	DWUCK CAL
GR.	0.0	0 +	
1	1.6602	2 +	*
2	1.8101	3 -	*
3	2.1906	4 +	
4	2.3232	6 +	
5	2.4233	2 +	
6	2.4779	0 +	
7	2.5880	4 +	
8	2.8000	2 +	
9	2.8840	4 +	
10	3.0210	4 +	
11	3.1238	7 -	
12	3.1980	4 -	
13	3.2280	3 -	
14	3.2550	1 -	
15	3.3080	6 +	
16	3.3100	6 +	
17	3.3620	4 -	
18	3.3761	8 +	
19	3.3930	3 -	
20	3.4050	3 -	
21	3.4605	9 -	
22	3.5300	3 -	
23	3.6501	8 +	
24	3.6710	5 -	
25	3.7340	3 -	
26	3.8490	4 -	
27	3.8530	9 -	
28	3.8591	8 +	
29	3.8690	5 -	

LEVELS ABOVE 3.869 MEV WERE ASSUMED TO BE OVERLAPPING.

FOR THE LEVELS WITH AN ASTERISK, THE CONTRIBUTION OF DIRECT INELASTIC SCATTERING CROSS SECTIONS WAS CALCULATED BY THE DWUCK-4 CODE/18/. DEFORMATION PARAMETERS (BETA2 = 0.088 AND BETA3 = 0.135) WERE BASED ON THE DATA COMPILED BY RAMAN ET AL./19/ AND SPEAR/20/, RESPECTIVELY.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/21/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (1.128E-4) WAS ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION OF 57 MILLI-BARNS AT 90 KEV MEASURED BY MACKLIN ET AL./2/

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT = 32 (N,N'D) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =106 (N,HE3) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
MT =111 (N,2P) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 158.4) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/22/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,P)	24.00 MB	(RECOMMENDED BY FORREST/23/)
(N,ALPHA)	10.20 MB	(SYSTEMATICS OF FORREST/23/)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. CONTRIBUTION OF DIRECT INELASTIC SCATTERING WAS CALCULATED WITH DWUCK-4. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING FROM OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 46.96-0.0172E	R0 = 6.237	A0 = 0.655
WS = 8.455	RS = 7.548	AS = 0.448
VSO= 7.0	RSO= 6.709	ASO= 0.6

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
60-ND-140	*	1.641E+01	5.532E-01	2.596E-01	5.024E+00	1.880E+00
60-ND-141		1.477E+01	6.091E-01	9.537E-01	4.587E+00	1.180E+00
60-ND-142		1.288E+01	6.710E-01	2.250E-01	5.526E+00	2.030E+00
60-ND-143		1.826E+01	4.710E-01	5.220E-01	3.613E+00	1.180E+00
61-PM-141	*	1.653E+01	5.508E-01	2.224E+00	3.845E+00	7.000E-01
61-PM-142	*	1.619E+01	5.484E-01	6.721E+00	2.997E+00	0.0
61-PM-143	*	1.430E+01	5.459E-01	6.683E-01	3.187E+00	8.500E-01
61-PM-144		1.831E+01	5.100E-01	1.011E+01	3.040E+00	0.0
62-SM-142	*	1.665E+01	5.484E-01	2.438E-01	5.066E+00	1.920E+00
62-SM-143		1.628E+01	5.431E-01	6.981E-01	4.167E+00	1.220E+00
62-SM-144		1.557E+01	5.543E-01	1.323E-01	4.951E+00	2.070E+00
62-SM-145		2.045E+01	4.343E-01	5.095E-01	3.596E+00	1.220E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 15.12 FOR SM-144 AND 5.0 FOR SM-145.

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MAT number = 6234

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 62-SM-147 JNDC         EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                        DIST-SEP90 REV2-AUG93
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.
93-08 JENDL-3.2 WAS MADE BY JNDC FPND W.G.

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)       UPPER BOUNDARY OF RESOLVED RESONANCE REGION
                    WAS CHANGED FROM 1.99 KEV TO 1.2 KEV.
     ***********************************************************


MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE PARAMETERS FOR MLBW FORMULA (BELOW 1.20 KEV)
      RESONANCE PARAMETERS FOR JENDL-2 EVALUATED BY KIKUCHI/3/
    WERE REVISED.
      FOR JENDL-2, THE DATA OF MIZUMOTO/4/ WERE ADOPTED.  THE
    J-ASSIGNMENT WAS BASED ON KVITECK AND POPOV/5/, CAUVIN ET
    AL./6/ AND KARZHAVINA ET AL./7/  ORBITAL ANGULAR MOMENTUM L
    WAS ASSUMED TO BE 0 FOR ALL RESONANCES.  AVERAGE RADIATION
    WIDTH AND SCATTERING RADIUS WERE TAKEN FROM MUGHABGHAB/8/.
      FOR JENDL-3, TOTAL SPIN J OF SOME RESONANCES WAS TENTATIVELY
    ESTIMATED WITH A RANDOM NUMBER METHOD.  PARAMETERS OF A NEGA-
    TIVE RESONANCE WERE MODIFIED SO AS TO REPRODUCE THE THERMAL
    CAPTURE CROSS SECTION GIVEN BY MUGHABGHAB.

  UNRESOLVED RESONANCE REGION : 1.2 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTION S0 WAS BASED ON THE COMPILATION
    OF MUGHABGHAB/8/, AND S1 AND S2 WERE CALCULATED WITH OPTICAL
    MODEL CODE CASTHY/9/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH GG WAS BASED ON THE COMPILATION OF
    MUGHABGHAB.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 4.800E-4, S1 = 1.000E-4, S2 = 4.700E-4, SG =120.E-4,
    GG = 0.069 EV, R  = 6.640 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL          59.07                    -
      ELASTIC         1.057                   -
      CAPTURE        58.01                  781
     (N,ALPHA)        5.783E-04

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/10/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE THE TOTAL CROSS SECTIONS OF NATURAL SM
  MEASURED BY FOSTER AND GLASGOW/11/, KELLIE ET AL./12/ AND SO
  ON, AND THE S-WAVE NEUTRON STRENGTH FUNCTION OF (4.8+-0.5)E-4
  /8/.  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/13/
     ALPHA    = HUIZENGA AND IGO/14/
     DEUTERON = LOHR AND HAEBERLI/15/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/16/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/17/ WERE EVALUATED BY IIJIMA ET AL./18/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /19/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).
```

MT = 4, 51 - 91 INELASTIC SCATTERING
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS ADOPTED. THE LEVEL SCHEME WAS TAKEN FROM REF./20/.

NO.	ENERGY(MEV)	SPIN-PARITY
GR.	0.0	7/2 -
1	0.1213	5/2 -
2	0.1974	3/2 -
3	0.7130	11/2 -
4	0.7988	3/2 -
5	0.8080	13/2 +
6	0.9250	11/2 +
7	1.0070	1/2 -
8	1.0290	11/2 +
9	1.0540	5/2 +
10	1.0650	5/2 +
11	1.0770	5/2 -
12	1.1030	9/2 -
13	1.1660	11/2 -
14	1.1800	7/2 -

LEVELS ABOVE 1.2 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/21/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (98.4E-4) WAS ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION OF 650 MILLI-BARNS AT 50 KEV MEASURED BY MACKLIN/22/.

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT = 32 (N,N'D) CROSS SECTION
MT = 33 (N,N'T) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =106 (N,HE3) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 25.0) WAS ASSUMED TO BE THE SAME AS THAT OF SM-148.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,P)	13.60 MB	(SYSTEMATICS OF FORREST/23/)
(N,ALPHA)	4.87 MB	(SYSTEMATICS OF FORREST)

THE (N,ALPHA) CROSS SECTION BELOW 1.99 KEV WAS CALCULATED FROM RESONANCE PARAMETERS, BY ASSUMING A MEAN ALPHA WIDTH OF 6.80E-7 EV SO AS TO REPRODUCE THE THERMAL CROSS SECTION/8/. THE CROSS SECTION WAS AVERAGED IN SUITABLE ENERGY INTERVALS. ABOVE 1.99 KEV, THE CROSS SECTION WAS CONNECTED SMOOTHLY TO THE PEGASUS CALCULATION.

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING FROM OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 43.42-0.1879E	R0 = 7.151	A0 = 0.6
WS = 9.875-0.0019E	RS = 7.04	AS = 0.45
VSO= 7.0	RSO= 7.151	ASO= 0.6

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
60-ND-143		1.826E+01	4.710E-01	5.220E-01	3.613E+00	1.180E+00
60-ND-144		1.771E+01	5.640E-01	4.792E-01	5.691E+00	1.940E+00
60-ND-145		2.054E+01	5.120E-01	2.465E+00	4.869E+00	1.180E+00
60-ND-146		2.019E+01	5.660E-01	1.121E+00	6.714E+00	2.100E+00
61-PM-144		1.831E+01	5.100E-01	1.011E+01	3.040E+00	0.0
61-PM-145	*	1.769E+01	5.411E-01	2.780E+00	4.120E+00	7.600E-01
61-PM-146	*	1.942E+01	5.387E-01	2.241E+01	3.849E+00	0.0
61-PM-147		2.192E+01	4.913E-01	4.801E+00	4.589E+00	9.200E-01
62-SM-145		2.045E+01	4.343E-01	5.095E-01	3.596E+00	1.220E+00
62-SM-146		1.871E+01	5.117E-01	2.497E-01	5.159E+00	1.980E+00
62-SM-147		2.275E+01	4.770E-01	2.660E+00	4.823E+00	1.220E+00
62-SM-148		2.097E+01	5.505E-01	1.055E+00	6.694E+00	2.140E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 9.964 FOR SM-147 AND 5.943 FOR SM-148.

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MAT number = 6237

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 62-SM-148 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-SEP90 REV2-NOV93
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.
93-11 JENDL-3.2 WAS MADE BY JNDC FPND W.G.

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)         UPPER BOUNDARY OF THE RESOLVED RESONANCE
                      REGION WAS CHANGED FROM 8 KEV TO 5.5 KEV.
      (3,2), (3,4)    EFFECTS OF MODIFICATION OF PARTIAL INELA-
                      STIC AND CAPTURE CROSS SECTIONS.
      (3,51), (3,52), (4,51), (4,52)
                      DIRECT COMPONENTS ADDED.
      (3,53-61), (3,91) AND THEIR ANGULAR DISTRIBUTIONS
                      EFFECTS OF RENORMALIZATION OF CAPTURE CROSS
                      SECTION.
      (3,102)         RENORMALIZATION
     ***********************************************************


MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 5.5 KEV
    RESONANCE PARAMETERS WERE NEWLY EVALUATED ON THE BASIS OF THE
    DATA MEASURED BY MIZUMOTO AND ZHAO/3,4/.
      RESONANCE ENERGIES AND NEUTRON WIDTHS WERE TAKEN FROM THE
    TRANSMISSION MEASURMENTS BY MIZUMOTO AND ZHAO.  RADIATION
    WIDTH OF 0.06 EV USED FOR THEIR ANALYSIS WAS ADOPTED.  A
    NEGATIVE RESONANCE WAS ADDED SO AS TO REPRODUCE THE THERMAL
    CAPTURE CROSS SECTION GIVEN BY MUGHABGHAB/5/.

  UNRESOLVED RESONANCE REGION : 5.5 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0 AND S1 WERE BASED ON THE
    COMPILATION OF MUGHABGHAB, AND S2 WAS CALCULATED WITH OPTICAL
    MODEL CODE CASTHY/6/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS OF
    MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 3.800E-4, S1 = 1.900E-4, S2 = 2.200E-4, SG = 4.97E-4,
    GG = 0.065 EV, R  = 5.150 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           3.4098                   -
      ELASTIC         0.9966                   -
      CAPTURE         2.4132                  45.2

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/7/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE THE TOTAL CROSS SECTION OF NATURAL SM
  MEASURED BY FOSTER AND GLASGOW/8/, KELLIE ET AL./9/ AND SO
  ON.  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/10/
     ALPHA    = HUIZENGA AND IGO/11/
     DEUTERON = LOHR AND HAEBERLI/12/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/13/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/14/ WERE EVALUATED BY IIJIMA ET AL./15/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /16/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
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    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./17/.

           NO.      ENERGY(MEV)    SPIN-PARITY (DIRECT)
           GR.       0.0             0  +
            1        0.5510          2  +          *
            2        1.1620          3  -          *
            3        1.1800          4  +
            4        1.4300          0  +
            5        1.4530          2  +
            6        1.4650          1  -
            7        1.5950          5  -
            8        1.6490          2  +
            9        1.6630          2  +
           10        1.7330          4  +
           11        1.8940          4  +
      LEVELS ABOVE 1.906 MEV WERE ASSUMED TO BE OVERLAPPING.

    FOR THE LEVELS WITH AN ASTERISK, THE CONTRIBUTION OF DIRECT
    INELASTIC SCATTERING CROSS SECTIONS WAS CALCULATED BY THE
    DWUCK-4 CODE/18/.  DEFORMATION PARAMETERS (BETA2=0.0202) AND
    BETA3=0.0251) WERE BASED ON THE DATA COMPILED BY RAMAN ET
    AL./19/ AND SPEAR/20/, RESPECTIVELY.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/21/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (4.73E-04) WAS ADJUSTED TO
    REPRODUCE THE CAPTURE CROSS SECTION OF 185 MILLI-BARNS AT 50
    KEV MEASURED BY WISSHAK ET AL./22/

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT = 32  (N,N'D) CROSS SECTION
  MT = 33  (N,N'T) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =106  (N,HE3) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (=  25.0) WAS DETERMINED TO REPRODUCE
    ENERGY DEPENDENCE OF THE (N,2N) CROSS SECTION MEASURED BY
    FREHAUT ET AL./23/

    FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,P)           8.00  MB (RECOMMENDED BY FORREST/24/)
      (N,ALPHA)       3.83  MB (SYSTEMATICS OF FORREST/24/)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING FROM OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                 DEPTH (MEV)         RADIUS(FM)    DIFFUSENESS(FM)
           ----------------------   ------------   ---------------
          V  = 46.96-0.0172E         R0 = 6.295     A0 = 0.655
          WS = 8.455                 RS = 7.617     AS = 0.448
          VSO= 7.0                   RSO= 6.771     ASO= 0.6
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THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
60-ND-144		1.771E+01	5.640E-01	4.792E-01	5.691E+00	1.940E+00
60-ND-145		2.054E+01	5.120E-01	2.465E+00	4.869E+00	1.180E+00
60-ND-146		2.019E+01	5.660E-01	1.121E+00	6.714E+00	2.100E+00
60-ND-147		2.398E+01	4.850E-01	5.510E+00	5.235E+00	1.180E+00
61-PM-145	*	1.769E+01	5.411E-01	2.780E+00	4.120E+00	7.600E-01
61-PM-146	*	1.942E+01	5.387E-01	2.241E+01	3.849E+00	0.0
61-PM-147		2.192E+01	4.913E-01	4.801E+00	4.589E+00	9.200E-01
61-PM-148		2.227E+01	4.300E-01	1.420E+01	2.672E+00	0.0
62-SM-146		1.871E+01	5.117E-01	2.497E-01	5.159E+00	1.980E+00
62-SM-147		2.275E+01	4.770E-01	2.660E+00	4.823E+00	1.220E+00
62-SM-148		2.097E+01	5.505E-01	1.055E+00	6.694E+00	2.140E+00
62-SM-149		2.325E+01	5.052E-01	5.886E+00	5.504E+00	1.220E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 5.943 FOR SM-148 AND 5.300 FOR SM-149.

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MAT number = 6240

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 62-SM-149 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 0.52 KEV
       PARAMETERS WERE BASED ON JENDL-2 WHICH WERE EVALUATED BY
    KIKUCHI ET AL./3/ AS FOLLOWS:  PARAMETERS OF THE LOWEST 2
    LEVELS WERE EVALUATED ON THE BASIS OF DATA MEASURED BY AKYUEZ
    ET AL./4/, ASAMI ET AL./5/ AND PATTENDEN/6/.  THE DATA OF
    MIZUMOTO/7/ WERE ADOPTED FOR OTHER RESONANCES.  THE J VALUES
    WERE DETERMINED ACCORDING TO MARSHAK/8/, CAUVIN ET AL./9/,
    KARZHAVINA ET AL./10/ AND BECVAR ET AL./11/ RADIATION WIDTHS
    HAVE BEEN MEASURED FOR SEVEN RESONANCES AND THEIR AVERAGE
    VALUE OF 62 MEV WAS USED AS A RECOMMENDED VALUE.
       FOR JENDL-3, TOTAL SPIN J OF SOME RESONANCES WAS
    TENTATIVELY ESTIMATED WITH A RANDOM NUMBER METHOD.  THE
    PARAMETERS OF THE 1ST LEVEL WERE MODIFIED SO AS TO REPRODUCE
    THE THERMAL CAPTURE CROSS SECTION AND RESONANCE INTEGRAL/12/.

  UNRESOLVED RESONANCE REGION : 0.52 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0 AND S1 WERE BASED ON THE
    COMPILATION OF MUGHABGHAB/12/, AND S2 WAS CALCULATED WITH
    OPTICAL MODEL CODE CASTHY/13/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH GG WAS BASED ON THE COMPILATION OF
    MUGHABGHAB.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 4.600E-4, S1 = 0.300E-4, S2 = 4.900E-4, SG = 487.E-4,
    GG = 0.062 EV, R  = 7.900 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                   2200 M/S               RES. INTEG.
      TOTAL       40330                       -
      ELASTIC       175.8                     -
      CAPTURE     40150                     3490
     (N,ALPHA)          0.0308

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/14/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE THE TOTAL CROSS SECTION OF NATURAL SM
  MEASURED BY FOSTER AND GLASGOW/15/, KELLIE ET AL./16/ AND SO ON,
  AND THE S-WAVE NEUTRON STRENGTH FUNCTION OF (4.6+-0.6)E-4/12/.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/17/
     ALPHA    = HUIZENGA AND IGO/18/
     DEUTERON = LOHR AND HAEBERLI/19/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/20/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/21/ WERE EVALUATED BY IIJIMA ET AL./22/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /23/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./24/.

           NO.      ENERGY(MEV)    SPIN-PARITY
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GR.	0.0	7/2 -
1	0.0225	5/2 -
2	0.2770	5/2 -
3	0.2859	9/2 -
4	0.3500	3/2 -
5	0.3990	1/2 -
6	0.5285	3/2 -
7	0.5584	5/2 -
8	0.5909	9/2 -
9	0.6060	3/2 -
10	0.6364	7/2 -

LEVELS ABOVE 0.65 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/25/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (324.E-4) WAS ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION OF 1200 MILLI-BARNS AT 50 KEV MEASURED BY MACKLIN/26/.

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT = 32 (N,N'D) CROSS SECTION
MT = 33 (N,N'T) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =106 (N,HE3) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 25.0) WAS ASSUMED TO BE THE SAME AS THAT OF SM-148.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,P)	8.10 MB	(SYSTEMATICS OF FORREST/27/)
(N,ALPHA)	3.02 MB	(SYSTEMATICS OF FORREST)

THE (N,ALPHA) CROSS SECTION BELOW 0.52 KEV WAS CALCULATED FROM RESONANCE PARAMETERS, BY ASSUMING A MEAN ALPHA WIDTH OF 4.82E-8 EV SO AS TO REPRODUCE THE THERMAL CROSS SECTION/12/. THE CROSS SECTION WAS AVERAGED IN SUITABLE ENERGY INTERVALS. ABOVE 0.52 KEV, THE CROSS SECTION WAS CONNECTED SMOOTHLY TO THE PEGASUS CALCULATION.

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING FROM OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

	DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V	= 43.42-0.1879E	R0 = 7.184	A0 = 0.6
WS	= 9.875-0.0019E	RS = 7.072	AS = 0.45
VSO	= 7.0	RSO= 7.184	ASO= 0.6

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
60-ND-145		2.054E+01	5.120E-01	2.465E+00	4.869E+00	1.180E+00
60-ND-146		2.019E+01	5.660E-01	1.121E+00	6.714E+00	2.100E+00

60-ND-147		2.398E+01	4.850E-01	5.510E+00	5.235E+00	1.180E+00
60-ND-148		2.359E+01	5.150E-01	1.328E+00	6.751E+00	2.170E+00
61-PM-146	*	1.942E+01	5.387E-01	2.241E+01	3.849E+00	0.0
61-PM-147		2.192E+01	4.913E-01	4.801E+00	4.589E+00	9.200E-01
61-PM-148		2.227E+01	4.300E-01	1.420E+01	2.672E+00	0.0
61-PM-149		2.377E+01	4.890E-01	8.141E+00	5.075E+00	9.900E-01
62-SM-147		2.275E+01	4.770E-01	2.660E+00	4.823E+00	1.220E+00
62-SM-148		2.097E+01	5.505E-01	1.055E+00	6.694E+00	2.140E+00
62-SM-149		2.325E+01	5.052E-01	5.886E+00	5.504E+00	1.220E+00
62-SM-150		2.362E+01	5.230E-01	1.520E+00	6.973E+00	2.210E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 5.300 FOR SM-149 AND 5.475 FOR SM-150.

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MAT number = 6243

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 62-SM-150 JNDC          EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                         DIST-SEP90 REV2-JUN94
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.
94-06 JENDL-3.2 WAS MADE BY JNDC FPND W.G.

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (3,2)        TO KEEP CONSISTENCY OF CROSS SECTIONS
      (3,4), (3,51), (3,53), (3,55), (3,59)
                   DIRECT INELASTIC SCATTERING CONTRIBUTION
                   WAS INCLUDED.
      (3,102)      RENORMALIZATION TO NEW EXPERIMENTAL DATA. THE
                   EFFECTS TO INELASTIC SCATTERING CROSS SECTIONS
                   ABOUT 1 % OR LESS.
      (4,51), (4,53), (4,55), (4,59)
                   DIRECT INELASTIC SCATTERING CONTRIBUTION
     ***********************************************************


MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 1.538 KEV
    RESONANCE PARAMETERS WERE TAKEN FROM JENDL-2 WHICH WAS
    EVALUATED BY KIKUCHI ET AL./3/ ON THE BASIS OF THE
    EXPERIMENTAL DATA BY EILAND ET AL./4/ AND BY ANUFRIEV ET
    AL./5/  THE AVERAGE RADIATION WIDTH OF 0.060 EV WAS ASSUMED.
    A NEGATIVE RESONANCE WAS ADDED AT -3.5 EV SO AS TO REPRODUCE
    THE CAPTURE CROSS SECTION OF 107+-9 BARNS AND THE TOTAL CROSS
    SECTION OF 122+-12 BARNS/4/.

  UNRESOLVED RESONANCE REGION : 1.538 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTION S0 WAS BASED ON THE COMPILATION
    OF MUGHABGHAB/6/, AND S1 AND S2 WERE CALCULATED WITH OPTICAL
    MODEL CODE CASTHY/7/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH GG WAS BASED ON THE COMPILATION OF
    MUGHABGHAB.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 3.600E-4, S1 = 1.400E-4, S2 = 2.300E-4, SG = 10.98E-4,
    GG = 0.060 EV, R  = 5.916 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                    2200 M/S                RES. INTEG.
      TOTAL        116.9                       -
      ELASTIC        8.341                     -
      CAPTURE      108.6                      325

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/8/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE THE TOTAL CROSS SECTION OF NATURAL SM
  MEASURED BY FOSTER AND GLASGOW/9/, KELLIE ET AL./10/ AND SO ON.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/11/
     ALPHA    = HUIZENGA AND IGO/12/
     DEUTERON = LOHR AND HAEBERLI/13/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/14/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/15/ WERE EVALUATED BY IIJIMA ET AL./16/   MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /17/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).
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MT = 4, 51 - 91 INELASTIC SCATTERING
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS ADOPTED. THE LEVEL SCHEME WAS TAKEN FROM REF./18/. THE LEVELS MARKED WITH * INCLUDE THE CONTRIBUTION OF DIRECT INELASTIC SCATTERING, WHICH WAS CALCUALTED BY THE COUPLED-CHANNELS THEORY WITH ECIS88 CODE/19/.   THE GROUND STATE ROTATIONAL BAND (0+ 2+ 4+ 6+(1.27891MEV)) AND OCTUPOLE VIBRATIONAL BAND (3- 1-(1.16573MEV) 5-) WERE COUPLED SIMULTANEOUSLY. THE WS PARAMETER WAS ADJUSTED TO 3.5 MEV, OTHERWISE THE SPHERICAL PARAMETERS WERE USED. THE BETA-2 (= 0.1931) AND BETA-3 (= 0.14526) WERE TAKEN FROM ORNL COMPILATIONS/20,21/.

NO.	ENERGY(MEV)	SPIN-PARITY	C.C. CALCULATION
GR.	0.0	0 +	
1	0.3343	2 +	*
2	0.7403	0 +	
3	0.7733	4 +	*
4	1.0463	2 +	
5	1.0720	3 -	*
6	1.1650	2 +	
7	1.1940	2 +	
8	1.2550	0 +	
9	1.3570	5 -	*
10	1.4170	2 +	
11	1.4490	4 +	
12	1.5050	3 +	
13	1.6430	4 +	
14	1.7610	0 +	
15	1.7940	2 +	
16	1.8200	4 +	
17	1.8340	2 +	
18	1.9270	2 +	
19	1.9510	3 -	
20	1.9710	4 +	

LEVELS ABOVE 2.006 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/22/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (1.098E-03) WAS ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION OF 320 MILLI-BARNS AT 50 KEV MEASURED BY WISSHAK ET AL./23/

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT = 32 (N,N'D) CROSS SECTION
MT = 33 (N,N'T) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 25.0) WAS ASSUMED TO BE THE SAME AS THAT OF SM-148.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
(N,P)   6.90 MB (RECOMMENDED BY FORREST/24/)
(N,ALPHA)   3.40 MB (RECOMMENDED BY FORREST)
THE (N,2N) CROSS SECTION WAS DETERMINED BY EYE-GUIDING OF THE DATA MEASURED BY FREHAUT ET AL./25/

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS

ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING FROM OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 46.96-0.0172E	R0 = 6.323	A0 = 0.655
WS = 8.455	RS = 7.651	AS = 0.448
VSO= 7.0	RSO= 6.801	ASO= 0.6

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
60-ND-146	2.019E+01	5.660E-01	1.121E+00	6.714E+00	2.100E+00
60-ND-147	2.398E+01	4.850E-01	5.510E+00	5.235E+00	1.180E+00
60-ND-148	2.359E+01	5.150E-01	1.328E+00	6.751E+00	2.170E+00
60-ND-149	2.657E+01	4.750E-01	1.192E+01	5.636E+00	1.180E+00
61-PM-147	2.192E+01	4.913E-01	4.801E+00	4.589E+00	9.200E-01
61-PM-148	2.227E+01	4.300E-01	1.420E+01	2.672E+00	0.0
61-PM-149	2.377E+01	4.890E-01	8.141E+00	5.075E+00	9.900E-01
61-PM-150	2.270E+01	3.800E-01	7.943E+00	1.973E+00	0.0
62-SM-148	2.097E+01	5.505E-01	1.055E+00	6.694E+00	2.140E+00
62-SM-149	2.325E+01	5.052E-01	5.886E+00	5.504E+00	1.220E+00
62-SM-150	2.362E+01	5.230E-01	1.520E+00	6.973E+00	2.210E+00
62-SM-151	2.687E+01	5.000E-01	2.313E+01	6.327E+00	1.220E+00

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 5.475 FOR SM-150 AND 6.675 FOR SM-151.

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MAT number = 6246

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 62-SM-151 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 0.2461 KEV
    RESONANCE PARAMETERS WERE EVALUATED BY KIKUCHI ET AL./3/ FOR
    JENDL-2, AND TOTAL SPIN J WAS MODIFIED WITH A RANDOM NUMBER
    METHOD FOR JENDL-3.
      NEUTRON WIDTHS WERE OBTAINED BY AVERAGING THE DATA OF
    PATTENDEN/4/, KIROUAC AND EILAND/5/ AND ANUFRIEV ET AL./6/
    RADIATION WIDTHS WERE TAKEN FROM REF./5/ OR THE AVERAGE VALUE
    OF 0.065+-0.015 EV WAS ADOPTED.  A NEGATIVE RESONANCE WAS
    ADDED AT -0.12 EV SO AS TO REPRODUCE THE THERMAL CAPTURE AND
    TOTAL CROSS SECTIONS GIVEN BY MUGHABGHAB/7/.

  UNRESOLVED RESONANCE REGION : 0.2461 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTION S0 WAS BASED ON THE COMPILATION
    OF MUGHABGHAB, AND S1 AND S2 WERE CALCULATED WITH THE OPTICAL
    MODEL CODE CASTHY/8/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH GG WAS BASED ON THE COMPILATION OF
    MUGHABGHAB.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 4.200E-4, S1 = 1.400E-4, S2 = 2.300E-4, SG = 481.E-4,
    GG = 0.092 EV, R  = 5.720 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S                RES. INTEG.
      TOTAL        15210                        -
      ELASTIC         50.41                     -
      CAPTURE      15160                      3410

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY/8/, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/9/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE THE TOTAL CROSS SECTION OF NATURAL SM
  MEASURED BY FOSTER AND GLASGOW/10/, KELLIE ET AL./11/ AND SO ON.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/12/
     ALPHA    = HUIZENGA AND IGO/13/
     DEUTERON = LOHR AND HAEBERLI/14/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/15/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/16/ WERE EVALUATED BY IIJIMA ET AL./17/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /18/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./19/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0            5/2 -
            1        0.0048         3/2 -
            2        0.0658         7/2 -
            3        0.0697         5/2 -
            4        0.0915         9/2 +
            5        0.1048         3/2 -
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          6        0.1479        13/2 +
          7        0.1677         5/2 +
          8        0.1684         5/2 -
          9        0.1754         9/2 -
         10        0.2090         7/2 -
         11        0.2611        11/2 -
         12        0.2850         1/2 -
         13        0.2946         9/2 -
         14        0.3026         5/2 -
         15        0.3068         3/2 +
         16        0.3138         1/2 -
         17        0.3153         3/2 -
         18        0.3239         7/2 +
         19        0.3449         3/2 +
         20        0.3576         1/2 +
     LEVELS ABOVE 0.37 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/20/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (5.57E-02) WAS DETERMINED FROM
    THE SYSTEMATICS.

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT = 32  (N,N'D) CROSS SECTION
  MT = 33  (N,N'T) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (=  25.0) WAS ASSUMED TO BE THE SAME
    AS THAT OF SM-148.

    FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,P)          4.83  MB (SYSTEMATICS OF FORREST/21/)
      (N,ALPHA)      1.90  MB (SYSTEMATICS OF FORREST)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING FROM OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
          ----------------------  ------------  ---------------
        V  = 46.96-0.0172E        R0 = 6.337    A0 = 0.655
        WS = 8.455                RS = 7.668    AS = 0.448
        VSO= 7.0                  RSO= 6.816    ASO= 0.6
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2  LEVEL DENSITY PARAMETERS

 NUCLIDE       A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
 ---------------------------------------------------------------
 60-ND-147     2.398E+01 4.850E-01 5.510E+00 5.235E+00 1.180E+00
 60-ND-148     2.359E+01 5.150E-01 1.328E+00 6.751E+00 2.170E+00
 60-ND-149     2.657E+01 4.750E-01 1.192E+01 5.636E+00 1.180E+00
 60-ND-150     2.415E+01 5.280E-01 1.867E+00 7.314E+00 2.290E+00

 61-PM-148     2.227E+01 4.300E-01 1.420E+01 2.672E+00 0.0
 61-PM-149     2.377E+01 4.890E-01 8.141E+00 5.075E+00 9.900E-01
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61-PM-150	2.270E+01	3.800E-01	7.943E+00	1.973E+00	0.0
61-PM-151	2.882E+01	4.260E-01	8.842E+00	4.956E+00	1.110E+00
62-SM-149	2.325E+01	5.052E-01	5.886E+00	5.504E+00	1.220E+00
62-SM-150	2.362E+01	5.230E-01	1.520E+00	6.973E+00	2.210E+00
62-SM-151	2.687E+01	5.000E-01	2.313E+01	6.327E+00	1.220E+00
62-SM-152	2.375E+01	5.470E-01	2.365E+00	7.669E+00	2.330E+00

SPIN CUTOFF PARAMS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 6.675 FOR SM-151 AND 5.306 FOR SM-152.

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MAT number = 6249

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 62-SM-152 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-SEP90 REV2-JUN94
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.
94-06 JENDL-3.2 WAS MADE BY JNDC FPND W.G.

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (3,2)        TO KEEP CONSISTENCY OF CROSS SECTIONS.
      (3,4), (3,51), (3,52), (3,55), (3,57), (3,60)
                   DIRECT INELASTIC SCATTERING CONTRIBUTION
                   WAS INCLUDED.
      (4,51), (4,52), (4,55), (4,57), (4,60)
                   DIRECT INELASTIC SCATTERING CONTRIBUTIONS.
     ***********************************************************


MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 5.029 KEV
    RESONANCE PARAMETERS WERE TAKEN FROM JENDL-2 WHICH WAS
    EVALUATED BY KIKUCHI ET AL./3/ AS FOLLOWS:
      PARAMETERS WERE ADOPTED FROM RAHN ET AL./4/  FOR THE
    LEVELS WHOSE RADIATION WIDTH WAS NOT MEASURED, THE AVERAGE
    VALUE OF 0.065+-0.015 EV WAS ASSUMED.  A NEGATIVE RESONANCE
    WAS ADDED AT -20 EV SO AS TO REPRODUCE THE CAPTURE CROSS
    SECTION OF 206+-6 BARNS AT 0.0253 EV/5/.

  UNRESOLVED RESONANCE REGION : 5.029 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0 AND S1 WERE BASED ON THE
    COMPILATION OF MUGHABGHAB/6/, AND S2 WAS CALCULATED WITH
    OPTICAL MODEL CODE CASTHY/7/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH GG WAS BASED ON THE COMPILATION OF
    MUGHABGHAB.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 2.200E-4, S1 = 0.550E-4, S2 = 2.300E-4, SG = 23.6E-4,
    GG = 0.061 EV, R  = 7.556 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                      2200 M/S               RES. INTEG.
      TOTAL          207.2                      -
      ELASTIC          0.9466                   -
      CAPTURE        206.2                    2770

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/8/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE THE TOTAL CROSS SECTION OF NATURAL SM
  MEASURED BY FOSTER AND GLASGOW/9/, KELLIE ET AL./10/ AND SO
  ON.  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/11/
     ALPHA    = HUIZENGA AND IGO/12/
     DEUTERON = LOHR AND HAEBERLI/13/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/14/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/15/ WERE EVALUATED BY IIJIMA ET AL./16/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /17/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
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```
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./18/.  THE
    LEVELS MARKED WITH * INCLUDE THE CONTRIBUTION OF DIRECT
    INELASTIC SCATTERING, WHICH WAS CALCUALTED BY THE COUPLED-
    CHANNELS THEORY WITH ECIS88 CODE/19/.  THE GROUND STATE
    ROTATIONAL BAND (0+ 2+ 4+ 6+(0.70696MEV)) AND OCTUPOLE
    VIBRATIONAL BAND (1- 3- 5-) WERE COUPLED SIMULTANEOUSLY.  THE
    WS PARAMETER WAS ADJUSTED TO 2.5 MEV,  OTHERWISE THE SPHERICAL
    PARAMETERS WERE USED.  THE BETA-2 (= 0.3055) AND BETA-3 (=
    0.09487) WERE TAKEN FROM ORNL COMPILATIONS/20, 21/.

           NO.      ENERGY(MEV)    SPIN-PARITY  C.C. CALCULATION
           GR.       0.0             0  +
            1        0.1230          2  +            *
            2        0.3670          4  +            *
            3        0.6880          0  +
            4        0.8170          2  +
            5        0.9640          1  -            *
            6        1.0260          4  +
            7        1.0450          3  -            *
            8        1.0860          2  +
            9        1.0900          0  +
           10        1.2250          5  -            *
           11        1.2350          3  +
      LEVELS ABOVE 1.298 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/22/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (1.48E-03) WAS ADJUSTED TO
    REPRODUCE THE CAPTURE CROSS SECTION OF 420 MILLI-BARNS AT 30
    KEV MEASURED BY MACKLIN ET AL./23/

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT = 33  (N,N'T) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (=  25.0) WAS ASSUMED TO BE THE SAME
    AS THAT OF SM-148.

    FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,P)          3.73  MB (SYSTEMATICS OF FORREST/24/)
      (N,ALPHA)      2.10  MB (RECOMMENDED BY FORREST/24/)
    THE (N,2N) CROSS SECTION WAS DETERMINED BY EYE-GUIDING OF THE
    DATA MEASURED BY FREHAUT ET AL./25/

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING FROM OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                 DEPTH (MEV)       RADIUS(FM)   DIFFUSENESS(FM)
          ----------------------  ------------  ---------------
        V  = 46.96-0.0172E        R0 = 6.351    A0 = 0.655
        WS = 8.455                RS = 7.685    AS = 0.448
        VSO= 7.0                  RSO= 6.831    ASO= 0.6
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2  LEVEL DENSITY PARAMETERS
```

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
60-ND-148		2.359E+01	5.150E-01	1.328E+00	6.751E+00	2.170E+00
60-ND-149		2.657E+01	4.750E-01	1.192E+01	5.636E+00	1.180E+00
60-ND-150		2.415E+01	5.280E-01	1.867E+00	7.314E+00	2.290E+00
60-ND-151		2.618E+01	4.800E-01	1.152E+01	5.656E+00	1.180E+00
61-PM-149		2.377E+01	4.890E-01	8.141E+00	5.075E+00	9.900E-01
61-PM-150		2.270E+01	3.800E-01	7.943E+00	1.973E+00	0.0
61-PM-151		2.882E+01	4.260E-01	8.842E+00	4.956E+00	1.110E+00
61-PM-152	*	2.440E+01	5.242E-01	1.481E+02	5.009E+00	0.0
62-SM-150		2.362E+01	5.230E-01	1.520E+00	6.973E+00	2.210E+00
62-SM-151		2.687E+01	5.000E-01	2.313E+01	6.327E+00	1.220E+00
62-SM-152		2.375E+01	5.470E-01	2.365E+00	7.669E+00	2.330E+00
62-SM-153		2.572E+01	5.160E-01	2.101E+01	6.405E+00	1.220E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 5.306 FOR SM-152 AND 10.66 FOR SM-153.

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MAT number = 6252

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 62-SM-153 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  NO RESOLVED RESONANCE PARAMETERS

  UNRESOLVED RESONANCE REGION : 4.4 EV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/2/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 2.300E-4, S1 = 1.200E-4, S2 = 2.400E-4, SG = 103.E-4,
    GG = 0.088 EV, R  = 7.146 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL         426.7                     -
      ELASTIC         6.700                   -
      CAPTURE       420.0                   717

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 4.4 EV, THE CAPTURE AND ELASTIC SCATTERING CROSS SECTIONS
  WERE ASSUMED TO BE IN 1/V FORM AND CONSTANT, RESPECTIVELY.
  THE CAPTURE CROSS SECTION AT 0.0253 EV WAS TAKEN FROM REF./3/
  AND THE SCATTERING CROSS SECTION WAS ESTIMATED FROM R = 7.3 FM.
  UNRESOLVED RESONANCE PARAMETERS WERE GIVEN IN THE ENERGY RANGE
  FROM 4.4 EV TO 100 KEV.

  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/4/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE THE TOTAL CROSS SECTION OF NATURAL SM
  MEASURED BY FOSTER AND GLASGOW/5/, KELLIE ET AL./6/ AND SO ON.
  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/7/
     ALPHA    = HUIZENGA AND IGO/8/
     DEUTERON = LOHR AND HAEBERLI/9/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/10/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/11/ WERE EVALUATED BY IIJIMA ET AL./12/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /13/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/14/ AND NUCLEAR DATA
    SHEETS/15/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0            3/2 +
            1        0.0075         5/2 +
            2        0.0358         3/2 -
            3        0.0535         7/2 +
            4        0.0655         9/2 +
            5        0.0909         5/2 -
            6        0.0984        11/2 -
            7        0.1273         3/2 -
            8        0.1742         7/2 -
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9	0.1829	5/2 -
10	0.1892	11/2 +
11	0.1946	5/2 +
12	0.1959	13/2 +
13	0.2463	13/2 -
14	0.2623	7/2 +
15	0.2659	7/2 -
16	0.2767	3/2 +
17	0.3211	3/2 +
18	0.3567	5/2 +
19	0.3623	5/2 +
20	0.3710	9/2 -
21	0.4055	3/2 -
22	0.4133	15/2 -
23	0.4149	1/2 +
24	0.4178	17/2 +
25	0.4253	15/2 +
26	0.4471	7/2 +
27	0.4500	5/2 -
28	0.4811	3/2 +

LEVELS ABOVE 0.492 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/16/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (1.00E-02) WAS DETERMINED FROM THE SYSTEMATICS OF RADIATION WIDTH (0.088 EV) AND THE AVERAGE S-WAVE RESONANCE LEVEL SPACING (8.76 EV) CALCULATED FROM THE LEVEL DENSITY PARAMETERS.

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT = 32 (N,N'D) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 25.0) WAS ASSUMED TO BE THE SAME AS THAT OF SM-148.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
(N,P) 2.88 MB (SYSTEMATICS OF FORREST/17/)
(N,ALPHA) 0.97 MB (SYSTEMATICS OF FORREST)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING FROM OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 46.96-0.0172E	R0 = 6.365	A0 = 0.655
WS = 8.455	RS = 7.702	AS = 0.448
VSO= 7.0	RSO= 6.846	ASO= 0.6

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
60-ND-149		2.657E+01	4.750E-01	1.192E+01	5.636E+00	1.180E+00

60-ND-150		2.415E+01	5.280E-01	1.867E+00	7.314E+00	2.290E+00
60-ND-151		2.618E+01	4.800E-01	1.152E+01	5.656E+00	1.180E+00
60-ND-152	*	2.361E+01	5.242E-01	1.915E+00	6.885E+00	2.100E+00
61-PM-150		2.270E+01	3.800E-01	7.943E+00	1.973E+00	0.0
61-PM-151		2.882E+01	4.260E-01	8.842E+00	4.956E+00	1.110E+00
61-PM-152	*	2.440E+01	5.242E-01	1.481E+02	5.009E+00	0.0
61-PM-153		2.285E+01	4.950E-01	7.324E+00	4.895E+00	9.200E-01
62-SM-151		2.687E+01	5.000E-01	2.313E+01	6.327E+00	1.220E+00
62-SM-152		2.375E+01	5.470E-01	2.365E+00	7.669E+00	2.330E+00
62-SM-153		2.572E+01	5.160E-01	2.101E+01	6.405E+00	1.220E+00
62-SM-154		2.190E+01	5.600E-01	1.960E+00	7.188E+00	2.140E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 10.66 FOR SM-153 AND 9.75 FOR SM-154.

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MAT number = 6255

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 62-SM-154 JNDC        EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                       DIST-SEP90 REV2-JUN94
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.
94-06 JENDL-3.2 WAS MADE BY JNDC FPND W.G.

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)      UPPER BOUNDARY OF RESOLVED RESONACE REGION
                   CHANGED FROM 4.654 TO 3 KEV.
      (3,2)        TO KEEP CONSISTENCY OF CROSS SECTIONS.
      (3,4), (3,51-56), (3,59), (3,64)
                   DIRECT INELASTIC SCATTERING CONTRIBUTION
                   WAS INCLUDED.
      (4,51-56), (4,59), (4,64)
                   DIRECT INELASTIC SCATTERING CONTRIBUTIONS.
     ***********************************************************


MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 4.654 KEV
    RESONANCE PARAMETERS WERE TAKEN FROM JENDL-2 EVALUATED BY
    KIKUCHI ET AL./3/ AND WERE MODIFIED FOR JENDL-3.
      FOR JENDL-2, PARAMETERS WERE ADOPTED FROM RAHN ET AL./4/
    FOR THE LEVELS WHOSE RADIATION WIDTH WAS NOT MEASURED, THE
    AVERAGE VALUE OF 0.079+-0.013 EV WAS ASSUMED.  A NEGATIVE
    RESONANCE WAS ADDED AT -35 EV SO AS TO REPRODUCE THE CAPTURE
    CROSS SECTION OF 5.5+-1.1 BARNS AT 0.0253 EV/5/.
      FOR JENDL-3, THE RADIATION WIDTH OF THE NEGATIVE RESONANCE
    WAS CHANGED FROM 0.079 EV TO 0.1266 EV AND THE SCATTERING
    RADIUS FROM 8.34 FM TO 9.67 FM SO AS TO REPRODUCE WELL THE
    THERMAL CROSS SECTIONS (CAPTURE = 8.4 B, SCATTERING = 11 B)
    COMPILED BY MUGHABGHAB/3/.

  UNRESOLVED RESONANCE REGION : 4.654 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0 AND S1 WERE BASED ON THE
    COMPILATION OF MUGHABGHAB, AND S2 WAS CALCULATED WITH OPTICAL
    MODEL CODE CASTHY/6/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH GG WAS BASED ON THE COMPILATION OF
    MUGHABGHAB.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 1.800E-4, S1 = 0.800E-4, S2 = 2.400E-4, SG = 7.09E-4,
    GG = 0.079 EV, R  = 7.680 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL          19.39                    -
      ELASTIC        11.00                    -
      CAPTURE         8.393                  36.3

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/7/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE THE TOTAL CROSS SECTION OF NATURAL SM
  MEASURED BY FOSTER AND GLASGOW/8/, KELLIE ET AL./9/ AND SO
  ON.  THE OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/10/
     ALPHA    = HUIZENGA AND IGO/11/
     DEUTERON = LOHR AND HAEBERLI/12/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/13/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/14/ WERE EVALUATED BY IIJIMA ET AL./15/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /16/.

  MT = 1  TOTAL
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      SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

    MT = 2  ELASTIC SCATTERING
      CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

    MT = 4, 51 - 91  INELASTIC SCATTERING
      SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
      ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./17/.  THE
      LEVELS MARKED WITH * INCLUDE THE CONTRIBUTION OF DIRECT
      INELASTIC SCATTERING, WHICH WAS CALCUALTED BY THE COUPLED-
      CHANNELS THEORY WITH ECIS88 CODE/18/.  THE GROUND STATE
      ROTATIONAL BAND (0+ 2+ 4+ 6+ 8+ 10+) AND OCTUPOLE VIBRATIONAL
      BAND (1- 3- 5-) WERE COUPLED SIMULTANEOUSLY.  THE WS PARAMETER
      WAS ADJUSTED TO 2.5 MEV.  OTHERWISE THE SPHERICAL PARAMETERS
      WERE USED.  THE BETA-2 (= 0.3410) AND BETA-3 (= 0.080) WERE
      TAKEN FROM ORNL COMPILATIONS/19, 20/.

             NO.      ENERGY(MEV)    SPIN-PARITY  C.C. CALCULATION
             GR.       0.0             0  +
              1        0.0820          2  +             *
              2        0.2670          4  +             *
              3        0.5470          6  +             *
              4        0.9060          8  +             *
              5        0.9210          1  -             *
              6        1.0120          3  -             *
              7        1.0990          0  +
              8        1.1780          2  +
              9        1.1820          5  -             *
             10        1.2020          0  +
             11        1.2860          3  -
             12        1.3380          4  +
             13        1.3720          4  +
             14        1.4010         10  +             *
             15        1.4400          2  +
             16        1.4750          1  -
             17        1.5150          3  +
             18        1.5390          3  +
             19        1.5850          3  -
             20        1.6620          4  +
             21        1.6740          0  +
             22        1.7070          4  +
             23        1.7550          2  +
             24        1.8170          4  +
        LEVELS ABOVE 1.85 MEV WERE ASSUMED TO BE OVERLAPPING.

    MT = 102  CAPTURE
      SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
      CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
      SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
      AND REFFO/21/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

      THE GAMMA-RAY STRENGTH FUNCTION (5.84E-4) WAS ADJUSTED TO
      REPRODUCE THE CAPTURE CROSS SECTION OF 70 MILLI-BARNS AT 200
      KEV MEASURED BY KONONOV ET AL./22/ AND BY FAWCETT ET AL./23/

    MT = 16  (N,2N) CROSS SECTION
    MT = 17  (N,3N) CROSS SECTION
    MT = 22  (N,N'A) CROSS SECTION
    MT = 28  (N,N'P) CROSS SECTION
    MT = 32  (N,N'D) CROSS SECTION
    MT = 33  (N,N'T) CROSS SECTION
    MT =103  (N,P) CROSS SECTION
    MT =104  (N,D) CROSS SECTION
    MT =105  (N,T) CROSS SECTION
    MT =107  (N,ALPHA) CROSS SECTION
      THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
      PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

      THE KALBACH'S CONSTANT K (=  25.0) WAS ASSUMED TO BE THE SAME
      AS THAT OF SM-148.

      FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
      NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
        (N,P)          2.23  MB (SYSTEMATICS OF FORREST/24/)
        (N,ALPHA)      0.85  MB (MEASURED BY BARI/25/)
      THE (N,2N) CROSS SECTION WAS DETERMINED BY EYE-GUIDING OF
      THE DATA MEASURED BY FREHAUT ET AL./26/

    MT = 251  MU-BAR
      CALCULATED WITH CASTHY.

  MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
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LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING FROM OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 46.96-0.0172E	R0 = 6.379	A0 = 0.655
WS = 8.455	RS = 7.719	AS = 0.448
VSO= 7.0	RSO= 6.861	ASO= 0.6

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
60-ND-150		2.415E+01	5.280E-01	1.867E+00	7.314E+00	2.290E+00
60-ND-151		2.618E+01	4.800E-01	1.152E+01	5.656E+00	1.180E+00
60-ND-152	*	2.361E+01	5.242E-01	1.915E+00	6.885E+00	2.100E+00
60-ND-153	*	2.297E+01	5.217E-01	7.977E+00	5.732E+00	1.180E+00
61-PM-151		2.882E+01	4.260E-01	8.842E+00	4.956E+00	1.110E+00
61-PM-152	*	2.440E+01	5.242E-01	1.481E+02	5.009E+00	0.0
61-PM-153		2.285E+01	4.950E-01	7.324E+00	4.895E+00	9.200E-01
61-PM-154	*	2.312E+01	5.193E-01	7.816E+01	4.543E+00	0.0
62-SM-152		2.375E+01	5.470E-01	2.365E+00	7.669E+00	2.330E+00
62-SM-153		2.572E+01	5.160E-01	2.101E+01	6.405E+00	1.220E+00
62-SM-154		2.190E+01	5.600E-01	1.960E+00	7.188E+00	2.140E+00
62-SM-155		2.402E+01	5.080E-01	8.478E+00	5.767E+00	1.220E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 9.75 FOR SM-154 AND 5.0 FOR SM-155.

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MAT number = 6300

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 63-EU-  0 JAERI,JNDC EVAL-MAR89 T.ASAMI, JNDC FP ND W.G.
                      DIST-OCT89 REV2-NOV93
HISTORY
89-03 EVALUATION FOR EACH ISOTOPE WAS MADE BY T.ASAMI(JAERI) AND
      JNDC FP NUCLEAR DATA W.G.  DATA FOR NATURAL EU WERE
      CONSTRUCTED FROM THE ISOTOPE DATA BY T.ASAMI AND
      T.NAKAGAWA(JAERI).
90-06 (MF3,MT251) MODIFIED.
93-11 JENDL-3.2
      GAMMA-RAY PRODUCTION DATA RE-EVALUATED BY T.ASAMI(DATA ENG.)
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)         SMALL MODIFICATION OF EU-153 PARAMETERS.
      (3,102)         Q-VALUES WERE CAHNGED.
      (12,102)        BELOW 21.64 KEV
      (15,102)        BELOW 21.64 KEV
     ***********************************************************


MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA)
    EVALUATION FOR EACH ISOTOPE WAS MADE BY KIKUCHI /1/.
    1) EU-151: BELOW 98.2 EV
       PARAMETERS WERE MAINLY BASED ON THE DATA OF RAHN ET AL.
       /2/, AND FOR THE LOWEST 2 LEVELS, THE DATA OF TASSAN ET
       AL./3/.  THE CAPTURE WIDTH OF 0.093 EV /2/ WAS ASSUMED FOR
       THE LEVELS WHOSE RADIATIVE CAPTURE WIDTH WAS NOT MEASURED.
       A NEGATIVE RESONANCE WAS ADDED SO AS TO REPRODUCE THE
       CAPTURE CROSS SECTION OF 9200 BARNS AT 0.0253 EV/4/.
    2) EU-153: BELOW 97.2 EV
       NEUTRON WIDTHS WERE OBTAINED FROM THE DATA OF RAHN ET AL.
       /2/ AND ANUFRIEV ET AL./5/.  RADIATIVE CAPTURE WIDTHS WERE
       ADOPTED FROM THE DATA OF RAHN ET AL.  THE PARAMETERS OF
       1.73-, 2.46-, 3.29- AND 3.94-EV LEVELS WERE TAKEN FROM
       MAGHABGHAB /6/ SO AS TO REPRODUCE THE CAPTURE RESONANCE
       INTEGRAL OF 1420 BARNS/6/.  A NEGATIVE RESONANCE WAS ADDED
       SO AS TO REPRODUCE THE CAPTURE CROSS SECTION OF 390 BARNS
       AND THE ELASTIC SCATTERING OF 8.0 +- 0.2 BARNS AT 0.0253
       EV/4/.
  UNRESOLVED RESONANCE REGION : UP TO 100 KEV
    THE PARAMETERS WERE ADJUSTED TO REPRODUCE THE CAPTURE CROSS
    SECTIONS.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED FROM
    FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
   1) EU-151
      S0 = 3.699E-4, S1 = 0.100E-4, S2 = 3.000E-4, GG = 0.091 EV
      D0 = 0.408 EV, R  = 6.870 FM.
   2) EU-153
      S0 = 2.602E-4, S1 = 1.394E-4, S2 = 2.946E-4, GG = 0.094 EV
      D0 = 1.489 EV, R  = 6.421 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL          4566.6                    -
      ELASTIC          6.925                   -
      CAPTURE        4559.7                  2202
     (N,ALPHA)         4.637E-06

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.

  MT = 1  TOTAL
    BELOW 10 MEV, CALCULATED WITH THE CASTHY CODE/7/. THE OPTICAL
    POTENTIAL PARAMETERS LISTED IN TABLE 1 USED.  ABOVE 10 MEV,
    CROSS SECTION WAS DETERMINED FROM THE DATA OF FOSTER AND
    GLASGOW/8/ FOR NATURAL EU.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51-71, 91  INELASTIC SCATTERING
    CALCULATED WITH THE CASTHY CODE/7/.  THE LEVEL SCHEME USED IN
    THE CALCULATIONS WAS TAKEN FROM REF./9/

              EU-151                        EU-153
```

NO	MT	ENERGY(MEV)	J-PARITY	NO.	MT	ENERGY(MEV)	J-PARITY
G.S		0.0	5/2+	G.S		0.0	5/2+
1	51	0.02150	7/2+	1	52	0.0834	7/2+
2	58	0.19620	11/2-	2	53	0.0974	5/2-
3	59	0.19650	3/2+	3	54	0.1032	3/2+
4	61	0.2432	7/2-	4	55	0.1516	7/2-
5	62	0.2604	5/2+	5	56	0.1729	5/2+
6	64	0.3070	7/2+	6	57	0.1931	9/2+
7	65	0.3075	5/2+	7	60	0.2353	9/2-
8	68	0.3498	9/2-	8	63	0.2697	7/2+
9	69	0.3536	7/2-	9	66	0.3219	11/2-
10	71	0.4160	7/2+	10	67	0.3251	11/2+
				11	70	0.3964	9/2+
CONT	91	0.420		CONT	91	0.400	

Q-VALUES OF EXCITED LEVELS WERE SHIFTED A LITTLE SO AS TO BE CONSISTENT WITH THRESHOLD ENERGIES.

MT = 102 CAPTURE
CALCULATED FROM EU-151 AND -153 CAPTURE CROSS SECTIONS. THE EU-151 CAPTURE CROSS SECTION BELOW 2 MEV WAS DETERMINED BY EYE-GUIDING THE DATA MEASURED BY MACKLIN AND YOUNG/10/, AND ABOVE 2 MEV, JENDL-2 DATA CALCULATED WITH CASTHY WAS NORMALIZED TO MACKLIN AND YOUNG AT 2 MEV. FOR EU-153, EVALUATION FOR JENDL-2 WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ADDED, WHICH WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/11/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

Q-VALUE WAS DETERMINED BY WEIGHTED AVERAGE.

MT=16, 17, 22, 28, 103, 107 (N,2N), (N,3N), (N,NA), (N,NP), (N,P) AND (N,A) CROSS SECTIONS
CALCULATED WITH THE GNASH CODE/12/ USING THE OPTICAL MODEL PARAMETERS IN TABLE 2, WHICH WERE DETERMINED SO AS TO REPRODUCE WELL THE TOTAL CROSS SECTION MEASURED BY FOSTER AND GLASGOW/8/ FOR NATURAL EU. THE LEVEL SCHEME DATA WERE TAKEN FROM REF./9/. THE CALCULATED (N,2N) AND (N,3N) CROSS SECTIONS WERE MODIFIED ON THE BASIS OF THE EXPERIMENTAL DATA OF FREHAUT ET AL./13/ AND BAYHURT/14/, RESPECTIVELY.

THE (N,ALPHA) CROSS SECTION IN THE RESONANCE REGION WAS CALCULATED FROM RESONANCE PARAMETERS, BY ASSUMING A MEAN ALPHA WIDTH OF 9.0E-11 EV FOR EU-151 AND 2.0E-10 EV FOR EU-153 SO AS TO REPRODUCE THE THERMAL CROSS SECTION/6/. THE CROSS SECTION WAS AVERAGED IN SUITABLE ENERGY INTERVALS. ABOVE THE RESOLVED RESONANCE REGION, THE CROSS SECTION WAS CONNECTED SMOOTHLY TO THE GNASH CALCULATION.

MT = 251 MU-BAR
CALCULATED WITH CASTHY/7/.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY/7/. FOR OTHER REACTIONS, THE ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH GNASH/12/.

MF = 12 PHOTON PRODUCTION MULTIPLICITIES
MT=102 (BELOW 21.6437 KEV)
CALCULUATED FROM ENERGY BALANCE.
MT=107 (BELOW 21.6437 KEV)
CALCULUATED WITH GNASH CODE/12/.

MF = 13 PHOTON PRODUCTION CROSS SECTIONS
MT=3 (ABOVE 21.6437 KEV)
CALCULUATED WITH GNASH CODE/12/.

MF = 14 PHOTON ANGULAR DISTRIBUTIONS
MT=3, 102
ASSUMED TO BE ISOTROPIC.

MF = 15 CONTINUOUS PHOTON ENERGY SPECTRA
MT=3, 102, 107
CALCULATED WITH GNASH CODE/12/. SPECTRA OF MT=102 AT 1.0E-5 EV AND 0.0253 EV WERE CALCULATED WITH CASTHY/7/.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS (FOR CASTHY)

```
V  = 43.71 - 0.0566*EN,      VSO = 7.9    (MEV)
WS = 7.696,                   WV = 0.0    (MEV)
 R = 1.270,  RS = 1.440,  RSO = 1.280    (FM)
 A = 0.60,    B = 0.45,   ASO = 0.60     (FM)
```

TABLE 2 NEUTRON OPTICAL POTENTIAL PARAMETERS (FOR GNASH)

```
V  = 43.71 - 0.05655*EN,     VSO = 0.0    (MEV)
WS = 7.696,                   WV = 0.0    (MEV)
 R = 1.272,  RS = 1.440,  RSO = 1.270    (FM)
 A = 0.48,    B = 0.45,   ASO = 0.48     (FM)
```

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MAT number = 6325

```
 63-EU-151 JAERI,JNDC EVAL-MAR89 T.ASAMI, JNDC FP ND W.G.
                      DIST-NOV90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
89-03 EVALUATION FOR JENDL-3 WAS MADE BY T.ASAMI(JAERI) AND JNDC
      FP NUCLEAR DATA W.G.

-----------------------------------------------------------------
DATA ARE THE SAME AS MAT=3631 OF JENDL-3 GENERAL PURPOSE FILE/2/.
-----------------------------------------------------------------

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 0.0982 KEV
       FOR JENDL-2, RESONANCE PARAMETERS WERE EVALUATED BY KIKUCHI
    ET AL./3/ THE PARAMETERS WERE ADOPTED MAINLY FROM THE DATA
    MEASURED BY RAHN ET AL./4/  FOR THE LOWEST 2 LEVELS, THE DATA
    OF TASSAN ET AL./5/ WERE ADOPTED.  THE AVERAGE RADIATION WIDTH
    OF 0.093 EV/4/ WAS ASSUMED FOR THE LEVELS WHOSE RADIATION
    WIDTH WAS NOT MEASURED.  A NEGATIVE RESONANCE WAS ADDED AT
    -0.00361 EV SO AS TO REPRODUCE THE CAPTURE CROSS SECTION OF
    9200+-100 BARNS AT 0.0253 EV/6/.
       FOR JENDL-3, TOTAL SPIN J OF SOME LEVELS WAS ESTIMATED
    WITH A RANDOM NUMBER METHOD.

  UNRESOLVED RESONANCE REGION : 0.0982 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS S0, S1, S2 WERE BASED ON THE
    COMPILATION OF MUGHABGHAB/7/.  THE OBSERVED LEVEL SPACING WAS
    ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION MEASURED BY
    MACKLIN AND YOUNG/8/.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 3.699E-4, S1 = 0.100E-4, S2 = 3.000E-4, SG = 2230.E-4,
    GG = 0.091 EV, R  = 6.870 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                        2200 M/S              RES. INTEG.
      TOTAL           9201                        -
      ELASTIC            3.207                    -
      CAPTURE         9198                      3070
     (N,ALPHA)           8.806E-06

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THEORETICAL CALCULATION WAS MADE BY USING THE
  OPTICAL AND STATISTICAL MODEL CODE CASTHY/9/ AND THE PREEQUILI-
  BRIUM AND STATISTICAL MODEL CODE GNASH/10/.  THE OMP'S FOR
  NEUTRON ARE GIVEN IN TABLES 1 AND 2, WHICH WERE DETERMINED SO AS
  TO REPRODUCE THE TOTAL CROSS SECTION OF NATURAL EU MEASURED BY
  FOSTER AND GLASGOW/11/.  THOSE FOR CHARGED PARTICLES ARE ADOPTED
  FROM MENET ET AL./12/ FOR PROTON AND FROM HUIZENGA AND IGO/13/
  FOR ALPHA PARTICLE.

  MT = 1  TOTAL
    BELOW 10 MEV, CALCULATION WITH CASTHY WAS ADOPTED.  THE
    OPTICAL POTENTIAL PARAMETERS LISTED IN TABLE 1 WERE USED.
    ABOVE 10 MEV, THE CROSS SECTION WAS DETERMINED BY EYE-GUIDING
    TO THE DATA OF FOSTER AND GLASGOW/11/ FOR NATURAL EU.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51-60, 91  INELASTIC SCATTERING
    CALCULATED WITH THE CASTHY CODE.  THE LEVEL SCHEME USED IN THE
    CALCULATIONS WAS TAKEN FROM REF./14/

        NO   LEVEL ENERGY(MEV)   SPIN-PARITY
       G.S      0.0                 5/2+
        1       0.02150             7/2+
        2       0.19620            11/2-
        3       0.19650             3/2+
        4       0.2432              7/2-
        5       0.2604              5/2+
        6       0.3070              7/2+
        7       0.3075              5/2+
        8       0.3498              9/2-
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         9       0.3536                7/2-
        10       0.4160                7/2+
        LEVELS ABOVE 0.420 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    BELOW 2 MEV, CROSS SECTION WAS DETERMINED BY EYE-GUIDING THE
    DATA MEASURED BY MACKLIN AND YOUNG/8/.  ABOVE 2 MEV, JENDL-2
    DATA CALCULATED WITH CASTHY WAS NORMALIZED TO MACKLIN AND
    YOUNG AT 2 MEV.  DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS
    WERE ADDED, WHICH WERE ESTIMATED ACCORDING TO THE PROCEDURE OF
    BENZI AND REFFO/15/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.


  MT=16, 17, 22, 28, 103, 107  (N,2N), (N,3N), (N,NA), (N,NP),
     (N,P) AND (N,A) CROSS SECTIONS
    CALCULATED WITH THE GNASH CODE USING THE OPTICAL MODEL
    PARAMETERS IN TABLE 2.  THE LEVEL SCHEME DATA WERE TAKEN FROM
    REF./14/.  THE CALCULATED (N,2N) AND (N,3N) CROSS SECTIONS
    WERE MODIFIED ON THE BASIS OF THE EXPERIMENTAL DATA OF FREHAUT
    ET AL./16/ AND BAYHURT/17/, RESPECTIVELY.

    THE (N,ALPHA) CROSS SECTION IN THE RESONANCE REGION WAS
    CALCULATED FROM RESONANCE PARAMETERS, BY ASSUMING A MEAN ALPHA
    WIDTH OF 9.0E-11 EV SO AS TO REPRODUCE THE THERMAL CROSS
    SECTION/7/.  THE CROSS SECTION WAS AVERAGED IN SUITABLE ENERGY
    INTERVALS.  ABOVE 98.2 EV, THE CROSS SECTION WAS CONNECTED
    SMOOTHLY TO THE GNASH CALCULATION.

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, THE ISOTROPIC
  DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  GNASH.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS (FOR CASTHY)

         V  = 43.71 - 0.0566*EN,     VSO = 7.9    (MEV)
         WS = 7.696,                  WV = 0.0    (MEV)
          R = 1.270,  RS = 1.440,  RSO = 1.280    (FM)
          A = 0.60,    B = 0.45,   ASO = 0.60     (FM)

TABLE 2  NEUTRON OPTICAL POTENTIAL PARAMETERS (FOR GNASH)

         V  = 43.71 - 0.05655*EN,    VSO = 0.0  (MEV)
         WS = 7.696,                  WV = 0.0    (MEV)
          R = 1.272,  RS = 1.440,  RSO = 1.270    (FM)
          A = 0.48,    B = 0.45,   ASO = 0.48     (FM)
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MAT number = 6328

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 63-EU-152 JNDC       EVAL-DEC90 JNDC FP NUCLEAR DATA W.G.
                      DIST-DEC90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.
90-12 STATISTICAL MODEL CALUCULATION WAS MADE BY RENORMALIZING
      THE CAPTURE CROSS SECTION.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 6.55 EV.
    RESONANCE PARAMETERS WERE TAKEN FROM JENDL-2 WHICH WAS
    EVALUATED BY KIKUCHI ET AL./3/ AS FOLLOWS:
      PARAMETERS WERE ADOPTED FROM THE DATA MEASURED BY VERTEBNY
    ET AL./4/  A NEGATIVE RESONANCE WAS ADDED SO AS TO REPRODUCE
    THE THERMAL CAPTURE CROSS SECTION GIVEN BY MUGHABGHAB/5/.
      FOR JENDL-3, TOTAL SPIN J WAS TENTATIVELY ESTIMATED WITH A
    RANDOM NUMBER METHOD.

  UNRESOLVED RESONANCE REGION : 0.00655 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTION S0 WAS BASED ON THE COMPILATION
    OF MUGHABGHAB/5/, AND S1 AND S2 WERE CALCULATED WITH OPTICAL
    MODEL CODE CASTHY/6/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH GG WAS BASED ON THE COMPILATION OF
    MUGHABGHAB.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 3.600E-4, S1 = 0.600E-4, S2 = 2.200E-4, SG = 3050.E-4,
    GG = 0.160 EV, R  = 6.200 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL       12800                         -
      ELASTIC        29.06                      -
      CAPTURE     12770                      2170

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/7/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED SO AS TO REPRODUCE THE EU-NATURAL TOTAL CROSS SECTION
  MEASURED BY FOSTER AND GLASGOW/8/.  THE OMP'S FOR CHARGED
  PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/9/
     ALPHA    = HUIZENGA AND IGO/10/
     DEUTERON = LOHR AND HAEBERLI/11/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/12/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/13/ WERE EVALUATED BY IIJIMA ET AL./14/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /15/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./16/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             3  -
            1        0.0485          0  -
            2        0.0682          1  -
            3        0.0723          3  -
            4        0.0899          4  +
            5        0.0923          1  -
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             6          0.1081           5  +
             7          0.1148           4  +
             8          0.1258           1  -
             9          0.1427           3  +
            10          0.1478           8  -
            11          0.1507           4  -
        LEVELS ABOVE 0.17 MEV WERE ASSUMED TO BE OVERLAPPING.

    MT = 102  CAPTURE
      SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
      CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
      SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
      AND REFFO/17/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

      THE GAMMA-RAY STRENGTH FUNCTION (11040.0E-4) WAS ADJUSTED TO
      REPRODUCE THE CAPTURE CROSS SECTION OF 3400 MILLI-BARNS AT 50
      KEV WHICH WAS 21 % LARGER THAN JENDL-2 CALCULATION/18/.

    NOTE : RESULTS OF PREVIOUS INTEGRAL TEST OF JENDL-2/1,18/ WERE
           REFLECTED IN THE PRESENT EVALUATION.

    MT = 16  (N,2N) CROSS SECTION
    MT = 17  (N,3N) CROSS SECTION
    MT = 22  (N,N'A) CROSS SECTION
    MT = 28  (N,N'P) CROSS SECTION
    MT = 32  (N,N'D) CROSS SECTION
    MT = 33  (N,N'T) CROSS SECTION
    MT =103  (N,P) CROSS SECTION
    MT =104  (N,D) CROSS SECTION
    MT =105  (N,T) CROSS SECTION
    MT =106  (N,HE3) CROSS SECTION
    MT =107  (N,ALPHA) CROSS SECTION
      THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
      PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

      THE KALBACH'S CONSTANT K (= 150.7) WAS ESTIMATED BY THE
      FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/19/ AND LEVEL
      DENSITY PARAMETERS.

      FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
      NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
        (N,P)          7.19  MB (SYSTEMATICS OF FORREST/20/)
        (N,ALPHA)      2.64  MB (SYSTEMATICS OF FORREST)

    MT = 251  MU-BAR
      CALCULATED WITH CASTHY.

  MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
    LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
    GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
    TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
    CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
    BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

  MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
    ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
    PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
    OTHER NEUTRON EMITTING REACTIONS.

  TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                 DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
           ----------------------  ------------  ---------------
          V  = 44.77-0.0164E       R0 = 6.788    A0 = 0.475
          WS = 6.878-0.1408E       RS = 7.685    AS = 0.45
          VSO= 7.0                 RSO= 6.788    ASO= 0.48
    THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

  TABLE 2  LEVEL DENSITY PARAMETERS

   NUCLIDE  SYST A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
   ---------------------------------------------------------------
   61-PM-148     2.227E+01 4.300E-01 1.420E+01 2.672E+00 0.0
   61-PM-149     2.377E+01 4.890E-01 8.141E+00 5.075E+00 9.900E-01
   61-PM-150     2.270E+01 3.800E-01 7.943E+00 1.973E+00 0.0
   61-PM-151     2.882E+01 4.260E-01 8.842E+00 4.956E+00 1.110E+00

   62-SM-149     2.325E+01 5.052E-01 5.886E+00 5.504E+00 1.220E+00
   62-SM-150     2.362E+01 5.230E-01 1.520E+00 6.973E+00 2.210E+00
   62-SM-151     2.687E+01 5.000E-01 2.313E+01 6.327E+00 1.220E+00
   62-SM-152     2.375E+01 5.470E-01 2.365E+00 7.669E+00 2.330E+00
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63-EU-150   *   2.325E+01 5.290E-01 9.836E+01 4.788E+00 0.0
63-EU-151       2.511E+01 4.680E-01 8.573E+00 4.962E+00 9.900E-01
63-EU-152       2.484E+01 4.850E-01 8.700E+01 4.264E+00 0.0
63-EU-153       2.195E+01 5.750E-01 1.698E+01 6.504E+00 1.110E+00
-------------------------------------------------------------------
 SYST:  * = LDP'S WERE DETERMINED FROM SYSTEMATICS.
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SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 8.852 FOR EU-152 AND 8.954 FOR EU-153.

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MAT number = 6331

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 63-EU-153 JEARI,JNDC EVAL-MAR89 T.ASAMI, JNDC FP ND W.G.
                      DIST-OCT89 REV2-JAN94
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
89-03 EVALUATION FOR JENDL-3 WAS MADE BY T.ASAMI(JAERI) AND
      JNDC FP NUCLEAR DATA W.G.
90-02 A RESONANCE AT 0.457 EV WAS REMOVED.
       THIS MODIFICATION WAS MADE ONLY FOR MAT=6303.
94-01 JENDL-3.2
      MODIFIED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)        0.457-EV RESONANCE WAS DELETED.
                         AFTER THIS MODIFICATION, THE DATA ARE
                         THE SAME AS MAT=6303 IN JENDL3.1.
      (3,1)*         BELOE 2 EV, 83.95-100 KEV, AROUND 10 MEV.
      (3,102)        Q-VALUE WAS CORRECTED.
      (3,107)*       BELOW 2 EV AND Q-VALUE CORRECTED.
           *) MODIFICATION WAS MADE ONLY TO MAT=3633 IN JENDL-3.1
     ***********************************************************


MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
    EVALUATION WAS MADE BY KIKUCHI /2/.  NEUTRON WIDTHS WERE
    OBTAINED BY AVERAGING THE DATA OF RAHN ET AL./3/ AND ANUFRIEV
    ET AL./4/.  RADIATIVE CAPTURE WIDTHS WERE ADOPTED FROM THE
    DATA MEASURED BY RAHN ET AL.  THE PARAMETERS OF 1.73-, 2.46-,
    3.29- AND 3.94-EV LEVELS WERE TAKEN FROM MUGHABGHAB /5/ SO AS
    TO REPRODUCE THE CAPTURE RESONANCE INTEGRAL OF 1420 +- 100
    BARNS RECOMMENDED IN REF./5/.  A NEGATIVE RESONANCE WAS ADDED
    AT -0.5 EV SO AS TO REPRODUCE THE CAPTURE CROSS SECTION OF 390
    +- 20 BARNS AND THE ELASTIC SCATTERING OF 8.0 +- 0.2 BARNS AT
    0.0253 EV /6/.
  UNRESOLVED RESONANCE REGION : 0.0972 KEV - 100 KEV
    INITIAL VALUES OF NEUTRON STRENGTH FUNCTIONS WERE THE SAME AS
    JENDL-2 CALCULATED WITH OPTICAL AND STATISTIACL MODEL CODE
    CASTHY/7/.  THEY WERE ADJUSTED TO THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY FOR JENDL-2 WHICH WAS IN GOOD AGREEMENT
    WITH EXPERIMENTAL DATA BY MACKLIN AND YOUNG/8/.  THE OBSERVED
    LEVEL SPACING WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS
    SECTION AT 30 KEV. THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 2.602E-4, S1 = 1.394E-4, S2 = 2.946E-4, GG = 0.094 EV
    D0 = 1.489 EV, R  = 6.421 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
```

	2200 M/S	RES. INTEG.
TOTAL	323.0	-
ELASTIC	10.33	-
CAPTURE	312.7	1410
(N,ALPHA)	7.1E-07	

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MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.

  MT = 1  TOTAL
    BELOW 10 MEV, CALCULATED WITH THE CASTHY CODE/7/. THE OPTICAL
    POTENTIAL PARAMETERS LISTED IN TABLE 1 USED.  ABOVE 10 MEV,
    DETERMINED FROM THE DATA OF FOSTER AND GLASGOW/9/ FOR
    NATURAL EU.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    CALCULATED WITH THE CASTHY CODE/7/.  THE LEVEL SCHEME USED IN
    THE CALCULATIONS WAS TAKEN FROM REF./10/
```

NO	LEVEL ENERGY(MEV)	SPIN-PARITY
G.S.	0.0	5/2+
1	0.0834	7/2+
2	0.0974	5/2-
3	0.1032	3/2+
4	0.1516	7/2-

5	0.1729	5/2+
6	0.1931	9/2+
7	0.2353	9/2-
8	0.2697	7/2+
9	0.3219	11/2-
10	0.3251	11/2+
11	0.3964	9/2+

LEVELS ABOVE 0.400 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE
CALCULATION FOR JENDL-2 WITH CASTHY/7/ WAS ADOPTED. THE FOLLOWING POTENTIAL PARAMETERS WERE DETERMINED BY IIJIMA ET AL. /11/ TO REPRODUCE A SYSTEMATIC TREND OF THE TOTAL CROSS SECTION.

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 49.61	R0 = 6.7926	A0 = 0.6
WS = 10.595	RS = 7.6483	AS = 0.45
WSO= 7.0	RSO= 6.8461	ASO= 0.6

PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GIRBERT-CAMERON WERE EVALUATED AS FOLLOWS/12/. THE COEFFICIENT OF SPIN CUT-OFF PARAMETER C1 WAS TAKEN AS 0.146. THE ENERGY DEPENDENCE OF SPIN CUT-OFF PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR /13/.

	EU-153	EU-154
PAIRING ENERGY (MEV)	1.100	0.0
A (1/MEV)	27.860	22.670
SPIN CUT-OFF PARAM.	19.567	19.972
NUCLEAR TEMP.(MEV)	0.455	0.432
C (1/MEV)	13.410	16.440
E-JOINT (MEV)	5.399	2.784

THE GAMMA-RAY STRENGTH FUNCTION (= 809.E-4) WAS ADJUSTED TO REPRODUCE THE EXPERIMENTAL CAPTURE CROSS SECTION OF 680 MILLI-BARNS AT 250 KEV MEASURED BY MACKLIN AND YOUNG/8/. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/14/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

MT=16, 17, 22, 28, 103, 107 (N,2N), (N,3N), (N,NA), (N,NP), (N,P) AND (N,A) CROSS SECTIONS
CALCULATED WITH THE GNASH CODE/15/ USING THE OPTICAL MODEL PARAMETERS IN TABLE 2, WHICH WERE DETERMINED SO AS TO REPRODUCE WELL THE TOTAL CROSS SECTION MEASURED BY FOSTER AND GLASGOW/9/ FOR NATURAL EU. THE LEVEL SCHEME DATA WERE TAKEN FROM REF./10/. THE CALCULATED (N,P) CROSS SECTION WAS NORMALIZED AT 14.5 MEV TO AN AVERAGE VALUE OF THE EXPERIMENTAL DATA AROUND 14.5 MEV/16,17,18,19/.

THE (N,ALPHA) CROSS SECTION IN THE RESONANCE REGION WAS CALCULATED FROM RESONANCE PARAMETERS, BY ASSUMING A MEAN ALPHA WIDTH OF 2.0E-10 EV SO AS TO REPRODUCE THE THERMAL CROSS SECTION/5/. THE CROSS SECTION WAS AVERAGED IN SUITABLE ENERGY INTERVALS. ABOVE 97.2 EV, THE CROSS SECTION WAS CONNECTED SMOOTHLY TO THE GNASH CALCULATION.

MT = 251 MU-BAR
CALCULATED WITH CASTHY/7/.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY/7/. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH GNASH/15/.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS (FOR CASTHY)

V = 43.71 - 0.0566*EN,		VSO = 7.9	(MEV)
WS = 7.696,		WV = 0.0	(MEV)
R = 1.270,	RS = 1.440,	RSO = 1.280	(FM)
A = 0.60,	B = 0.45,	ASO = 0.60	(FM)

TABLE 2 NEUTRON OPTICAL POTENTIAL PARAMETERS (FOR GNASH)

```
V  = 43.71 - 0.05655*EN,    VSO = 0.0   (MEV)
WS = 7.696,                   WV = 0.0   (MEV)
 R = 1.272,  RS = 1.440,  RSO = 1.270   (FM)
 A = 0.48,    B = 0.45,   ASO = 0.48    (FM)
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MAT number = 6334

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 63-EU-154 JNDC       EVAL-DEC90 JNDC FP NUCLEAR DATA W.G.
                      DIST-DEC90 REV2-NOV93
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.
90-12 STATISTICAL MODEL CALUCULATION WAS MADE BY RENORMALIZING
      THE CAPTURE CROSS SECTION.
93-11 JENDL-3.2 WAS MADE BY JNDC FPND W.G.

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)         RESOLVED RESONANCE PARAMETERS.  NEGATIVE
                      RESONANCE PARAMETERS WERE MODIFIED.
     ***********************************************************


MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 0.0262 KEV
    RESONANCE PARAMETERS IN JENDL-2 WERE REPLACED WITH THE RECOM-
    MENDATION BY MUGHABGHAB/3/.  TOTAL SPIN J WAS TENTATIVELY
    ESTIMATED WITH A RANDOM NUMBER METHOD.  PARAMETERS OF THE
    NEGATIVE LEVEL WERE ADJUSTED TO THE THERMAL CAPTURE CROSS
    SECTION AND RESONANCE INTEGRAL MEASURED BY SEKINE ET AL./4/

  UNRESOLVED RESONANCE REGION : 0.0262 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/5/.
    THE OBSERVED LEVEL SPACING WAS DETERMINED TO REPRODUCE THE
    CAPTURE CROSS SECTION CALCULATED WITH CASTHY.  THE
    EFFECTIVE SCATTERING RADIUS WAS OBTAINED FROM FITTING TO THE
    CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH WAS BASED ON THE COMPILATION OF
    MUGHABGHAB /3/.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 2.200E-4, S1 = 0.940E-4, S2 = 2.300E-4, SG = 2740.E-4,
    GG = 0.126 EV, R  = 7.006 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                      2200 M/S               RES. INTEG.
      TOTAL         1848.2                       -
      ELASTIC          6.581                     -
      CAPTURE       1841.6                     1180

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/6/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED SO AS TO REPRODUCE THE EU-NATURAL TOTAL CROSS SECTION
  MEASURED BY FOSTER AND GLASGOW/7/.  THE OMP'S FOR CHARGED
  PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/8/
     ALPHA    = HUIZENGA AND IGO/9/
     DEUTERON = LOHR AND HAEBERLI/10/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/11/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/12/ WERE EVALUATED BY IIJIMA ET AL./13/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /14/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./15/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0              3  -
```

1	0.0682	4	+
2	0.0957	4	+
3	0.0971	5	+
4	0.1000	5	-
5	0.1008	4	+
6	0.1367	5	+
7	0.1800	8	-

LEVELS ABOVE 0.2 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/16/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (2840.0E-4) WAS ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION OF 2610 MILLI-BARNS AT 50 KEV WHICH WAS 20 % LARGER THAN JENDL-2 CALCULATION/17/.

NOTE : RESULTS OF PREVIOUS INTEGRAL TEST OF JENDL-2/1,17/ WERE REFLECTED IN THE PRESENT EVALUATION.

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT = 32 (N,N'D) CROSS SECTION
MT = 33 (N,N'T) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 183.4) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/18/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
(N,P) 4.32 MB (SYSTEMATICS OF FORREST/19/)
(N,ALPHA) 1.68 MB (SYSTEMATICS OF FORREST)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 44.77-0.0164E	R0 = 6.818	A0 = 0.475
WS = 6.878-0.1408E	RS = 7.719	AS = 0.45
VSO= 7.0	RSO= 6.818	ASO= 0.48

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
61-PM-150		2.270E+01	3.800E-01	7.943E+00	1.973E+00	0.0
61-PM-151		2.882E+01	4.260E-01	8.842E+00	4.956E+00	1.110E+00
61-PM-152	*	2.440E+01	5.242E-01	1.481E+02	5.009E+00	0.0
61-PM-153		2.285E+01	4.950E-01	7.324E+00	4.895E+00	9.200E-01
62-SM-151		2.687E+01	5.000E-01	2.313E+01	6.327E+00	1.220E+00
62-SM-152		2.375E+01	5.470E-01	2.365E+00	7.669E+00	2.330E+00
62-SM-153		2.572E+01	5.160E-01	2.101E+01	6.405E+00	1.220E+00
62-SM-154		2.190E+01	5.600E-01	1.960E+00	7.188E+00	2.140E+00

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63-EU-152     2.484E+01 4.850E-01 8.700E+01 4.264E+00 0.0
63-EU-153     2.195E+01 5.750E-01 1.698E+01 6.504E+00 1.110E+00
63-EU-154     2.267E+01 4.320E-01 1.644E+01 2.784E+00 0.0
63-EU-155     2.083E+01 5.200E-01 5.190E+00 4.837E+00 9.200E-01
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 SYST:  * = LDP'S WERE DETERMINED FROM SYSTEMATICS.
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SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 15.98 FOR EU-154 AND 8.187 FOR EU-155.

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MAT number = 6337
 63-EU-155 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-SEP90 REV2-NOV93
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.
93-11 JENDL-3.2 WAS MADE BY JNDC FPND W.G.

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)         RESOLVED RESONANCE PARAMETERS.  NEGATIVE
                      RESONANCE PARAMETERS WERE MODIFIED.
     ***********************************************************


MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 29.7 EV
       RESONANCE PARAMETERS WERE BASED ON JENDL-2 EVALUATION BY
    KUKICHI ET AL./3/ WHICH WERE MADE ON THE BASIS OF THE DATA
    MEASURED BY ANUFRIEV ET AL./4/  A NEGATIVE RESONANCE WAS
    ADDED SO AS TO REPRODUCE THE THERMAL CAPTURE CROSS SECTION
    GIVEN BY MUGHABGHAB/5/.
       FOR JENDL-3, TOTAL SPIN J WAS TENTATIVELY ESTIMATED WITH A
    RANDOM NUMBER METHOD.  PARAMETERS OF THE NEGATIVE LEVEL WERE
    ADJUSTED TO THE THERMAL CAPTURE CROSS SECTION AND RESONANCE
    INTEGRAL MEASURED BY SEKINE ET AL./6/

  UNRESOLVED RESONANCE REGION : 0.0297 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/7/.  THE OBSERVED LEVEL SPACING
    WAS DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULA-
    TED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH GG WAS BASED ON THE COMPILATION OF
    MUGHABGHAB/5/.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 2.300E-4, S1 = 0.500E-4, S2 = 2.300E-4, SG = 226.E-4,
    GG = 0.094 EV, R  = 7.036 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                       2200 M/S               RES. INTEG.
      TOTAL         3765.0                      -
      ELASTIC          6.566                    -
      CAPTURE       3758.4                  15600

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/8/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED SO AS TO REPRODUCE THE EU-NATURAL TOTAL CROSS SECTION
  MEASURED BY FOSTER AND GLASGOW/9/.  THE OMP'S FOR CHARGED
  PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/10/
     ALPHA    = HUIZENGA AND IGO/11/
     DEUTERON = LOHR AND HAEBERLI/12/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/13/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/14/ WERE EVALUATED BY IIJIMA ET AL./15/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /16/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./17/.

           NO.      ENERGY(MEV)    SPIN-PARITY
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GR.	0.0	5/2 +
1	0.0786	7/2 +
2	0.1043	5/2 -
3	0.1690	7/2 -
4	0.1800	9/2 +
5	0.2457	3/2 +
6	0.3074	5/2 +
7	0.3570	11/2 -
8	0.3920	7/2 +

LEVELS ABOVE 0.42 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/18/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (2.08E-02) WAS DETERMINED FROM THE SYSTEMATICS OF RADIATION WIDTH (0.10 EV) AND THE AVERAGE S-WAVE RESONANCE LEVEL SPACING (4.8 EV) CALCULATED FROM THE LEVEL DENSITY PARAMETERS.

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT = 32 (N,N'D) CROSS SECTION
MT = 33 (N,N'T) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 186.7) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/19/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,P)	3.35 MB	(SYSTEMATICS OF FORREST/20/)
(N,ALPHA)	1.34 MB	(SYSTEMATICS OF FORREST)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING FROM OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 44.77-0.0164E	R0 = 6.833	A0 = 0.475
WS = 6.878-0.1408E	RS = 7.735	AS = 0.45
VSO= 7.0	RSO= 6.833	ASO= 0.48

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
61-PM-151		2.882E+01	4.260E-01	8.842E+00	4.956E+00	1.110E+00
61-PM-152	*	2.440E+01	5.242E-01	1.481E+02	5.009E+00	0.0
61-PM-153		2.285E+01	4.950E-01	7.324E+00	4.895E+00	9.200E-01
61-PM-154	*	2.312E+01	5.193E-01	7.816E+01	4.543E+00	0.0
62-SM-152		2.375E+01	5.470E-01	2.365E+00	7.669E+00	2.330E+00
62-SM-153		2.572E+01	5.160E-01	2.101E+01	6.405E+00	1.220E+00
62-SM-154		2.190E+01	5.600E-01	1.960E+00	7.188E+00	2.140E+00
62-SM-155		2.402E+01	5.080E-01	8.478E+00	5.767E+00	1.220E+00

63-EU-153	2.195E+01	5.750E-01	1.698E+01	6.504E+00	1.110E+00
63-EU-154	2.267E+01	4.320E-01	1.644E+01	2.784E+00	0.0
63-EU-155	2.083E+01	5.200E-01	5.190E+00	4.837E+00	9.200E-01
63-EU-156	2.084E+01	4.030E-01	6.286E+00	1.992E+00	0.0

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 8.187 FOR EU-155 AND 1.324 FOR EU-156.

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MAT number = 6340

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 63-EU-156 JNDC        EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                       DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  NO RESOLVED RESONANCE PARAMETERS

  UNRESOLVED RESONANCE REGION : 1 EV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2 WERE CALCULATED
    WITH OPTICAL MODEL CODE CASTHY/2/.  THE OBSERVED LEVEL SPACING
    WERE DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION
    CALCULATED WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.  THE RADIATION WIDTH GG WAS BASED ON THE SYSTEMATICS
    OF MEASURED VALUES FOR NEIGHBORING NUCLIDES.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 2.300E-4, S1 = 0.520E-4, S2 = 2.400E-4, SG = 42.1E-4,
    GG = 0.100 EV, R  = 7.074 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                   2200 M/S                RES. INTEG.
      TOTAL       106.6                       -
      ELASTIC       6.600                     -
      CAPTURE     100.0                     1430

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 1.0 EV, THE CAPTURE AND ELASTIC SCATTERING CROSS SECTIONS
  WERE ASSUMED TO BE IN 1/V FORM AND CONSTANT, RESPECTIVELY.
  THE CAPTURE CROSS SECTION AT 0.0253 EV WAS DETERMINED WITH THE
  SYSTEMATICS FROM THE NEIGHBORING NUCLIDES.  THE SCATTERING CROSS
  SECTION WAS ESTIMATED FROM R = 7.3 FM.  UNRESOLVED RESONANCE
  PARAMETERS WERE GIVEN IN THE ENERGY RANGE FROM 1.0 EV TO 100
  KEV.

  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY/2/, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/3/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED SO AS TO REPRODUCE THE EU-NATURAL TOTAL CROSS SECTION
  MEASURED BY FOSTER AND GLASGOW/4/.  THE OMP'S FOR CHARGED
  PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/5/
     ALPHA    = HUIZENGA AND IGO/6/
     DEUTERON = LOHR AND HAEBERLI/7/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/8/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/9/ WERE EVALUATED BY IIJIMA ET AL./10/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /11/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/12/ AND NUCLEAR DATA
    SHEETS/13/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             0  +
            1        0.0226          1  +
            2        0.0478          0  +
            3        0.0872          1  -
            4        0.1253          2  -
            5        0.2911          1  +
      LEVELS ABOVE 0.33 MEV WERE ASSUMED TO BE OVERLAPPING.
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MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/14/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (3.82E-03) WAS DETERMINED FROM THE SYSTEMATICS OF RADIATION WIDTH (0.1 EV) AND THE AVERAGE S-WAVE RESONANCE LEVEL SPACING (26.2 EV) CALCULATED FROM THE LEVEL DENSITY PARAMETERS.

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT = 32 (N,N'D) CROSS SECTION
MT = 33 (N,N'T) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 223.6) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/15/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,P)	2.60 MB	(SYSTEMATICS OF FORREST/16/)
(N,ALPHA)	1.08 MB	(SYSTEMATICS OF FORREST)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 44.77-0.0164E	R0 = 6.848	A0 = 0.475
WS = 6.878-0.1408E	RS = 7.752	AS = 0.45
VSO= 7.0	RSO= 6.848	ASO= 0.48

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
61-PM-152	*	2.440E+01	5.242E-01	1.481E+02	5.009E+00	0.0
61-PM-153		2.285E+01	4.950E-01	7.324E+00	4.895E+00	9.200E-01
61-PM-154	*	2.312E+01	5.193E-01	7.816E+01	4.543E+00	0.0
61-PM-155	*	2.246E+01	5.169E-01	1.385E+01	5.040E+00	7.300E-01
62-SM-153		2.572E+01	5.160E-01	2.101E+01	6.405E+00	1.220E+00
62-SM-154		2.190E+01	5.600E-01	1.960E+00	7.188E+00	2.140E+00
62-SM-155		2.402E+01	5.080E-01	8.478E+00	5.767E+00	1.220E+00
62-SM-156	*	2.260E+01	5.145E-01	1.309E+00	6.251E+00	1.950E+00
63-EU-154		2.267E+01	4.320E-01	1.644E+01	2.784E+00	0.0
63-EU-155		2.083E+01	5.200E-01	5.190E+00	4.837E+00	9.200E-01
63-EU-156		2.084E+01	4.030E-01	6.286E+00	1.992E+00	0.0
63-EU-157		1.975E+01	5.400E-01	6.628E+00	4.704E+00	7.300E-01

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 1.324 FOR EU-156 AND 5.0 FOR EU-157.

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MAT number = 6425

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 64-GD-152 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 2.66 KEV
       RESONANCE PARAMETERS BELOW 10 EV WERE EVALUATED ON THE
    BASIS OF MUGHABGHAB/2/.
       ABOVE 12 EV, PARAMETERS WERE ADOPTED FROM MACKLIN/3/.  FOR
    THE RESONANCES ONLY WHOSE CAPTURE AREA WAS MEASURED, NEUTRON
    WIDTHS WERE DETERMINED FROM THE CAPTURE AREA AND AN AVERAGE
    RADIATION WIDTH OF 0.0586 EV/3/.  THE TOTAL SPIN J AND ORBITAL
    ANGULAR MOMENTUM L WERE ASSIGNED BY CONSIDERING THE MAGNITUDE
    OF THE CAPTURE AREA OF EACH RESONANCE.
       A NEGATIVE RESONANCE WAS ADDED SO AS TO REPRODUCE THE
    THERMAL CAPTURE CROSS SECTION OF 735+-20 BARNS AND THE CAPTURE
    RESONANCE INTEGRAL OF 2020+-160 BARNS/2/.
       SCATTERING RADIUS OF 8.2 FM WAS ESTIMATED FROM AN OPTICAL
    MODEL CALCULATION SHOWN IN FIG. 2 OF REF./2/.

  UNRESOLVED RESONANCE REGION : 2.66 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTION S0 WAS BASED ON THE COMPILATION
    OF MUGHABGHAB, AND S1 AND S2 WERE CALCULATED WITH OPTICAL
    MODEL CODE CASTHY/4/.  THE OBSERVED LEVEL SPACING WAS ADJUSTED
    TO REPRODUCE THE CAPTURE CROSS SECTION MEASURED BY BEER AND
    MACKLIN/5/. THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED FROM
    FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.  THE
    RADIATION WIDTH GG WAS BASED ON THE COMPILATION OF MUGHABGHAB.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 4.600E-4, S1 = 1.100E-4, S2 = 2.400E-4, SG = 50.6E-4,
    GG = 0.054 EV, R  = 3.918 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                      2200 M/S               RES. INTEG.
      TOTAL        1070                         -
      ELASTIC        13.92                      -
      CAPTURE      1056                       991
     (N,ALPHA)        6.957E-03

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/6/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  ADOPTED FROM IIJIMA AND KAWAI/7/ AND WS WAS CHANGED.  THE OMP'S
  FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/8/
     ALPHA    = HUIZENGA AND IGO/9/
     DEUTERON = LOHR AND HAEBERLI/10/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/11/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/12/ WERE EVALUATED BY IIJIMA ET AL./13/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /14/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/15/ AND NUCLEAR DATA
    SHEETS/16/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             0  +
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              1        0.3443          2  +
              2        0.6154          0  +
              3        0.7554          4  +
              4        0.9306          2  +
              5        1.0478          0  +
              6        1.1092          2  +
              7        1.1232          3  -
              8        1.2273          6  +
              9        1.2823          4  +
             10        1.3147          1  -
             11        1.3184          2  +
             12        1.4340          3  +
             13        1.4605          1  -
             14        1.4705          5  -
             15        1.5502          4  +
             16        1.6056          2  +
             17        1.6434          2  -
             18        1.6681          6  +
             19        1.6924          4  +
             20        1.7467          8  +
             21        1.7560          1  -
             22        1.7716          2  +
             23        1.8077          4  +
             24        1.8396          2  +
             25        1.8615          5  +
             26        1.8620          2  +
             27        1.8802          7  -
             28        1.9154          2  +
             29        1.9412          2  +
        LEVELS ABOVE 1.975 MEV WERE ASSUMED TO BE OVERLAPPING.

    MT = 102  CAPTURE
      SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
      CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
      SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
      AND REFFO/17/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

      THE GAMMA-RAY STRENGTH FUNCTION (39.9E-4) WAS ADJUSTED TO
      REPRODUCE THE CAPTURE CROSS SECTION OF 531 MILLI-BARNS AT 250
      KEV MEASURED BY BEER AND MACKLIN/5/.

    MT = 16  (N,2N) CROSS SECTION
    MT = 17  (N,3N) CROSS SECTION
    MT = 22  (N,N'A) CROSS SECTION
    MT = 28  (N,N'P) CROSS SECTION
    MT = 32  (N,N'D) CROSS SECTION
    MT = 33  (N,N'T) CROSS SECTION
    MT =103  (N,P) CROSS SECTION
    MT =104  (N,D) CROSS SECTION
    MT =105  (N,T) CROSS SECTION
    MT =106  (N,HE3) CROSS SECTION
    MT =107  (N,ALPHA) CROSS SECTION
      THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
      PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

      THE KALBACH'S CONSTANT K (= 104.0) WAS ESTIMATED BY THE
      FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/18/ AND LEVEL
      DENSITY PARAMETERS.

      FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
      NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
        (N,P)          13.60  MB (SYSTEMATICS OF FORREST/19/)
        (N,ALPHA)       4.62  MB (SYSTEMATICS OF FORREST)

      THE (N,ALPHA) CROSS SECTION BELOW 2.66 KEV WAS CALCULATED FROM
      RESONANCE PARAMETERS, BY ASSUMING A MEAN ALPHA WIDTH OF 4.5E-6
      EV SO AS TO REPRODUCE THE THERMAL CROSS SECTION/2/.  THE
      CROSS SECTION WAS AVERAGED IN SUITABLE ENERGY INTERVALS.
      ABOVE 2.66 KEV, THE CROSS SECTION WAS CONNECTED SMOOTHLY TO
      THE PEGASUS CALCULATION.

    MT = 251  MU-BAR
      CALCULATED WITH CASTHY.

  MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
    LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
    GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
    TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
    CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
    BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

  MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
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ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

	DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V	= 38.0	R0 = 7.439	A0 = 0.47
WS	= 8.0	RS = 7.439	AS = 0.52
VSO	= 7.0	RSO= 7.439	ASO= 0.47

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
62-SM-148		2.097E+01	5.505E-01	1.055E+00	6.694E+00	2.140E+00
62-SM-149		2.325E+01	5.052E-01	5.886E+00	5.504E+00	1.220E+00
62-SM-150		2.362E+01	5.230E-01	1.520E+00	6.973E+00	2.210E+00
62-SM-151		2.687E+01	5.000E-01	2.313E+01	6.327E+00	1.220E+00
63-EU-149	*	2.146E+01	5.314E-01	8.410E+00	5.238E+00	9.200E-01
63-EU-150	*	2.325E+01	5.290E-01	9.836E+01	4.788E+00	0.0
63-EU-151		2.511E+01	4.680E-01	8.573E+00	4.962E+00	9.900E-01
63-EU-152		2.484E+01	4.850E-01	8.700E+01	4.264E+00	0.0
64-GD-150	*	2.160E+01	5.290E-01	1.363E+00	6.202E+00	1.890E+00
64-GD-151	*	2.340E+01	5.266E-01	1.595E+01	5.750E+00	9.700E-01
64-GD-152		2.470E+01	4.810E-01	1.302E+00	6.106E+00	1.960E+00
64-GD-153		2.484E+01	5.130E-01	2.189E+01	5.847E+00	9.700E-01

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 8.194 FOR GD-152 AND 5.0 FOR GD-153.

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MAT number = 6431

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 64-GD-154 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
90-03 NEW EVALUATION FOR JENDL-3 WAS COMPLETED BY JNDC FPND
      W.G./1/

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 2.76 KEV
       RESONANCE PARAMETERS BELOW 486 EV WERE EVALUATED ON THE
    BASIS OF MUGHABGHAB/2/.
       ABOVE 486 EV, PARAMETERS WERE ADOPTED FROM MACKLIN/3/.  FOR
    THE RESONANCES ONLY WHOSE CAPTURE AREA WAS MEASURED, NEUTRON
    WIDTHS WERE DETERMINED FROM THE CAPTURE AREA AND AN AVERAGE
    RADIATION WIDTH OF 0.088 EV/2/.  THE TOTAL SPIN J AND ORBITAL
    ANGULAR MOMENTUM L WERE ASSIGNED BY CONSIDERING THE MAGNITUDE
    OF THE CAPTURE AREA OF EACH RESONANCE.
       A NEGATIVE RESONANCE WAS ADDED SO AS TO REPRODUCE THE
    THERMAL CAPTURE CROSS SECTION OF 85+-12 BARNS/2/.
       SCATTERING RADIUS OF 8.0 FM WAS ESTIMATED FROM AN OPTICAL
    MODEL CALCULATION SHOWN IN FIG. 2 OF REF./2/.

  UNRESOLVED RESONANCE REGION : 2.76 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTION S0 WAS BASED ON THE COMPILATION
    OF MUGHABGHAB, AND S1 AND S2 WERE CALCULATED WITH OPTICAL
    MODEL CODE CASTHY/4/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH GG WAS BASED ON THE COMPILATION OF
    MUGHABGHAB.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 2.000E-4, S1 = 1.100E-4, S2 = 2.400E-4, SG = 45.9E-4,
    GG = 0.088 EV, R  = 6.802 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL          92.35                     -
      ELASTIC         7.356                    -
      CAPTURE        84.99                    215

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/5/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  ADOPTED FROM IIJIMA AND KAWAI/6/ AND WS WAS CHANGED.  THE OMP'S
  FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/7/
     ALPHA    = HUIZENGA AND IGO/8/
     DEUTERON = LOHR AND HAEBERLI/9/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/10/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/11/ WERE EVALUATED BY IIJIMA ET AL./12/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /13/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED. THE LEVEL SCHEME WAS BASED ON EVALUATED NUCLEAR
    STRUCTURE DATA FILE (1987 VERSION)/14/ AND NUCLEAR DATA
    SHEETS/15/.

           NO.       ENERGY(MEV)    SPIN-PARITY
           GR.        0.0             0  +
            1         0.1231          2  +
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2	0.3710	4	+
3	0.6807	0	+
4	0.7177	6	+
5	0.8155	2	+
6	0.9963	2	+
7	1.0476	4	+
8	1.1278	3	+
9	1.1445	8	+
10	1.2413	1	-
11	1.2516	3	-
12	1.2638	4	+
13	1.2951	0	+
14	1.3650	5	-
15	1.3659	6	+
16	1.3975	2	-
17	1.4145	1	-
18	1.4184	2	+
19	1.4323	5	+
20	1.5313	2	+
21	1.5596	4	-
22	1.6066	6	+
23	1.6172	3	-
24	1.6458	4	+
25	1.6609	3	+
26	1.6983	4	+
27	1.7196	2	-
28	1.7567	8	+

LEVELS ABOVE 1.77 MEV WERE ASSUMED TO BE OVERLAPPING.

MT = 102 CAPTURE
SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY WAS ADOPTED. DIRECT AND SEMI-DIRECT CAPTURE CROSS SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI AND REFFO/16/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

THE GAMMA-RAY STRENGTH FUNCTION (42.8E-4) WAS ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION OF 680 MILLI-BARNS AT 50 KEV MEASURED BY BEER AND MACKLIN/17/

MT = 16 (N,2N) CROSS SECTION
MT = 17 (N,3N) CROSS SECTION
MT = 22 (N,N'A) CROSS SECTION
MT = 28 (N,N'P) CROSS SECTION
MT = 32 (N,N'D) CROSS SECTION
MT =103 (N,P) CROSS SECTION
MT =104 (N,D) CROSS SECTION
MT =105 (N,T) CROSS SECTION
MT =107 (N,ALPHA) CROSS SECTION
THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

THE KALBACH'S CONSTANT K (= 106.1) WAS ESTIMATED BY THE FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/18/ AND LEVEL DENSITY PARAMETERS.

FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:

(N,P)	8.23 MB	(SYSTEMATICS OF FORREST/19/)
(N,ALPHA)	2.91 MB	(SYSTEMATICS OF FORREST)

MT = 251 MU-BAR
CALCULATED WITH CASTHY.

MF = 4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELASTIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91. THEY WERE CALCULATED WITH CASTHY. FOR OTHER REACTIONS, ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR OTHER NEUTRON EMITTING REACTIONS.

TABLE 1 NEUTRON OPTICAL POTENTIAL PARAMETERS

DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
V = 38.0	R0 = 7.439	A0 = 0.47
WS = 8.0	RS = 7.439	AS = 0.52
VSO= 7.0	RSO= 7.439	ASO= 0.47

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
62-SM-150	2.362E+01	5.230E-01	1.520E+00	6.973E+00	2.210E+00
62-SM-151	2.687E+01	5.000E-01	2.313E+01	6.327E+00	1.220E+00
62-SM-152	2.375E+01	5.470E-01	2.365E+00	7.669E+00	2.330E+00
62-SM-153	2.572E+01	5.160E-01	2.101E+01	6.405E+00	1.220E+00
63-EU-151	2.511E+01	4.680E-01	8.573E+00	4.962E+00	9.900E-01
63-EU-152	2.484E+01	4.850E-01	8.700E+01	4.264E+00	0.0
63-EU-153	2.195E+01	5.750E-01	1.698E+01	6.504E+00	1.110E+00
63-EU-154	2.267E+01	4.320E-01	1.644E+01	2.784E+00	0.0
64-GD-152	2.470E+01	4.810E-01	1.302E+00	6.106E+00	1.960E+00
64-GD-153	2.484E+01	5.130E-01	2.189E+01	5.847E+00	9.700E-01
64-GD-154	2.349E+01	5.270E-01	2.018E+00	6.893E+00	2.080E+00
64-GD-155	2.500E+01	5.100E-01	2.181E+01	5.822E+00	9.700E-01

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 9.839 FOR GD-154 AND 7.017 FOR GD-155.

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MAT number = 6434
 64-GD-155 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 0.1818 KEV
      RESONANCE PARAMETERS WERE BASED ON JENDL-2 EVALUATION.
    PARAMETERS OF 3 LEVELS BELOW 2.6 EV WERE TAKEN FROM THE DATA
    OF MOLLER ET AL./3/  THESE ABOVE 3.6 EV WERE BASED ON THE
    MEASURED DATA BY FRIESENHAHN ET AL./4/ AND BY RIBON/5/.  THE
    AVERAGE RADIATION WIDTH OF 0.12865 EV WAS ASSUMED.  SCATTERING
    RADIUS OF 6.7 FM WAS ADOPTED FROM BNL 325(3RD.)/6/.
      FOR JENDL-3, TOTAL SPIN J OF J-UNKNOWN LEVELS WAS ESTIMATED
    WITH A RANDOM NUMBER METHOD.

  UNRESOLVED RESONANCE REGION : 0.1818 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTION S0 WAS BASED ON THE COMPILATION
    OF MUGHABGHAB/7/, AND S1 AND S2 WERE CALCULATED WITH OPTICAL
    MODEL CODE CASTHY/8/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH GG WAS BASED ON THE COMPILATION OF
    MUGHABGHAB.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 2.000E-4, S1 = 1.100E-4, S2 = 2.300E-4, SG = 1260.E-4,
    GG = 0.110 EV, R  = 6.826 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL       60950                       -
      ELASTIC        58.82                    -
      CAPTURE     60890                     1540
     (N,ALPHA)       8.175E-05

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/9/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  ADOPTED FROM IIJIMA AND KAWAI/10/, AND WS WAS CHANGED.  THE
  OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/11/
     ALPHA    = HUIZENGA AND IGO/12/
     DEUTERON = LOHR AND HAEBERLI/13/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/14/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/15/ WERE EVALUATED BY IIJIMA ET AL./16/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /17/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./18/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             3/2 -
            1        0.0600          5/2 -
            2        0.0865          5/2 +
            3        0.1053          3/2 +
            4        0.1076          9/2 +
            5        0.1180          7/2 +
            6        0.1215         11/2 -
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         7         0.1461          7/2  -
         8         0.2143         13/2  +
         9         0.2352          3/2  +
        10         0.2510          9/2  -
        11         0.2667          5/2  +
        12         0.2686          3/2  +
        13         0.2869          3/2  -
        14         0.3215          5/2  -
        15         0.3260          5/2  +
        16         0.3677          1/2  +
        17         0.3900         11/2  -
        18         0.3930          7/2  -
        19         0.4225          1/2  -
        20         0.4272          3/2  +
        21         0.4513          3/2  -
        22         0.4870          5/2  -
        23         0.4888          5/2  +
        24         0.5330         13/2  -
        25         0.5560          7/2  -
        26         0.5599          1/2  -
        27         0.5924          3/2  -
        28         0.6155          3/2  -
        29         0.6170          9/2  -
     LEVELS ABOVE 0.648 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/19/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (1.28E-01) WAS ADJUSTED TO
    REPRODUCE THE CAPTURE CROSS SECTION OF 1520 MILLI-BARNS AT 100
    KEV MEASURED BY SHORIN ET AL./20/ AND BY NAKAJIMA ET AL./21/
    THE FINAL RESULTS WERE DETERMINED BY EYE-GUIDING OF THE DATA
    OF REFS./20,21/.

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT = 32  (N,N'D) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (= 147.6) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/22/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,P)            6.41  MB (SYSTEMATICS OF FORREST/23/)
      (N,ALPHA)        2.33  MB (SYSTEMATICS OF FORREST)

    THE (N,ALPHA) CROSS SECTION BELOW 181.8 EV WAS CALCULATED FROM
    RESONANCE PARAMETERS, BY ASSUMING A MEAN ALPHA WIDTH OF
    1.45E-10 EV SO AS TO REPRODUCE THE THERMAL CROSS SECTION/7/.
    THE CROSS SECTION WAS AVERAGED IN SUITABLE ENERGY INTERVALS.
    ABOVE 181.8 EV, THE CROSS SECTION WAS CONNECTED SMOOTHLY TO
    THE PEGASUS CALCULATION.

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS
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	DEPTH (MEV)	RADIUS(FM)	DIFFUSENESS(FM)
	V = 38.0	R0 = 7.439	A0 = 0.47
	WS = 8.0	RS = 7.439	AS = 0.52
	VSO= 7.0	RSO= 7.439	ASO= 0.47

THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
62-SM-151	2.687E+01	5.000E-01	2.313E+01	6.327E+00	1.220E+00
62-SM-152	2.375E+01	5.470E-01	2.365E+00	7.669E+00	2.330E+00
62-SM-153	2.572E+01	5.160E-01	2.101E+01	6.405E+00	1.220E+00
62-SM-154	2.190E+01	5.600E-01	1.960E+00	7.188E+00	2.140E+00
63-EU-152	2.484E+01	4.850E-01	8.700E+01	4.264E+00	0.0
63-EU-153	2.195E+01	5.750E-01	1.698E+01	6.504E+00	1.110E+00
63-EU-154	2.267E+01	4.320E-01	1.644E+01	2.784E+00	0.0
63-EU-155	2.083E+01	5.200E-01	5.190E+00	4.837E+00	9.200E-01
64-GD-153	2.484E+01	5.130E-01	2.189E+01	5.847E+00	9.700E-01
64-GD-154	2.349E+01	5.270E-01	2.018E+00	6.893E+00	2.080E+00
64-GD-155	2.500E+01	5.100E-01	2.181E+01	5.822E+00	9.700E-01
64-GD-156	2.254E+01	5.200E-01	1.630E+00	6.286E+00	1.890E+00

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 7.017 FOR GD-155 AND 9.458 FOR GD-156.

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MAT number = 6437

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 64-GD-156 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE PARAMETERS FOR MLBW FORMULA (BELOW 2.214 KEV)
    RESONANCE PARAMETERS WERE TAKEN FROM JENDL-2.  EVALUATION FOR
    JENDL-2 WAS MADE ON THE BASIS OF THE DATA BY KARZHAVINA ET AL.
    /3/ AND BY COCEVA AND STEFANON/4/.  THE AVERAGE RADIATION
    WIDTH OF 0.10611 EV WAS ASSUMED.  SCATTERING RADIUS OF 8.1 FM
    WAS ADOPTED FROM BNL 325(3RD.)/5/.

  UNRESOLVED RESONANCE REGION : 2.214 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS S0, S1, S2 WERE BASED ON THE
    COMPILATION OF MUGHABGHAB/6/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY/7/.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH GG WAS BASED ON THE COMPILATION OF
    MUGHABGHAB.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 1.700E-4, S1 = 0.550E-4, S2 = 2.600E-4, SG = 36.7E-4,
    GG = 0.088 EV, R  = 7.363 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           6.991                    -
      ELASTIC         4.804                    -
      CAPTURE         2.188                   121

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/8/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  ADOPTED FROM IIJIMA AND KAWAI/9/, AND WS WAS CHANGED.  THE OMP'S
  FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/10/
     ALPHA    = HUIZENGA AND IGO/11/
     DEUTERON = LOHR AND HAEBERLI/12/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/13/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/14/ WERE EVALUATED BY IIJIMA ET AL./15/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /16/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./17/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             0  +
            1        0.0890          2  +
            2        0.2882          4  +
            3        0.5847          6  +
            4        0.9651          8  +
            5        1.0494          0  +
            6        1.1294          2  +
            7        1.1541          2  +
            8        1.1681          0  +
            9        1.2424          1  -
           10        1.2480          3  +
           11        1.2580          2  +
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              12         1.2761          3  -
              13         1.2981          4  +
              14         1.3196          2  -
              15         1.3554          4  +
              16         1.3664          1  -
              17         1.4082          5  -
              18         1.4147         10  +
              19         1.4623          4  +
              20         1.5069          5  +
              21         1.5105          4  +
              22         1.5388          3  +
              23         1.6225          5  +
              24         1.7152          0  +
              25         1.7710          1  +
              26         1.8279          2  +
              27         1.8517          3  -
         LEVELS ABOVE 1.916 MEV WERE ASSUMED TO BE OVERLAPPING.

     MT = 102  CAPTURE
       SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
       CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
       SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
       AND REFFO/18/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

       THE GAMMA-RAY STRENGTH FUNCTION (2.32E-03) WAS ADJUSTED TO
       REPRODUCE THE CAPTURE CROSS SECTION OF 480 MILLI-BARNS AT 50
       KEV MEASURED BY SHORIN ET AL./19/ AND KONONOV ET AL./20/

     MT = 16  (N,2N) CROSS SECTION
     MT = 17  (N,3N) CROSS SECTION
     MT = 22  (N,N'A) CROSS SECTION
     MT = 28  (N,N'P) CROSS SECTION
     MT = 32  (N,N'D) CROSS SECTION
     MT =103  (N,P) CROSS SECTION
     MT =104  (N,D) CROSS SECTION
     MT =105  (N,T) CROSS SECTION
     MT =107  (N,ALPHA) CROSS SECTION
       THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
       PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

       THE KALBACH'S CONSTANT K (= 145.7) WAS ESTIMATED BY THE
       FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/21/ AND LEVEL
       DENSITY PARAMETERS.

       FINALLY, THE (N,2N), (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
       NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
         (N,2N)      1700.00  MB (SYSTEMATICS OF WEN DEN LU+/22/)
         (N,P)          6.99  MB (SYSTEMATICS OF FORREST/23/)
         (N,ALPHA)      3.10  MB (RECOMMENDED BY FORREST/23/)

     MT = 251  MU-BAR
       CALCULATED WITH CASTHY.

   MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
     LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
     GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
     TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
     CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
     BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

   MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
     ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
     PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
     OTHER NEUTRON EMITTING REACTIONS.

   TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                    DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
             ----------------------   ------------  ---------------
            V  = 38.0                 R0 = 7.439    A0 = 0.47
            WS = 8.0                  RS = 7.439    AS = 0.52
            VSO= 7.0                  RSO= 7.439    ASO= 0.47
     THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

   TABLE 2  LEVEL DENSITY PARAMETERS

    NUCLIDE       A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
    ---------------------------------------------------------------
    62-SM-152     2.375E+01 5.470E-01 2.365E+00 7.669E+00 2.330E+00
    62-SM-153     2.572E+01 5.160E-01 2.101E+01 6.405E+00 1.220E+00
    62-SM-154     2.190E+01 5.600E-01 1.960E+00 7.188E+00 2.140E+00
    62-SM-155     2.402E+01 5.080E-01 8.478E+00 5.767E+00 1.220E+00
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63-EU-153	2.195E+01	5.750E-01	1.698E+01	6.504E+00	1.110E+00
63-EU-154	2.267E+01	4.320E-01	1.644E+01	2.784E+00	0.0
63-EU-155	2.083E+01	5.200E-01	5.190E+00	4.837E+00	9.200E-01
63-EU-156	2.084E+01	4.030E-01	6.286E+00	1.992E+00	0.0
64-GD-154	2.349E+01	5.270E-01	2.018E+00	6.893E+00	2.080E+00
64-GD-155	2.500E+01	5.100E-01	2.181E+01	5.822E+00	9.700E-01
64-GD-156	2.254E+01	5.200E-01	1.630E+00	6.286E+00	1.890E+00
64-GD-157	2.278E+01	5.210E-01	1.077E+01	5.454E+00	9.700E-01

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 9.458 FOR GD-156 AND 8.107 FOR GD-157.

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MAT number = 6440
 64-GD-157 JNDC        EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                       DIST-NOV90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF=2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE PARAMETERS FOR MLBW FORMULA (BELOW 303.7 EV)
    RESONANCE PARAMETERS WERE BASED ON JENDL-2, AND TOTAL SPIN J
    OF SOME RESONANCES WAS ESTIMATED FOR JENDL-3 WITH A RANDOM
    NUMBER METHOD.  EVALUATION FOR JENDL-2 WAS MADE ON THE BASIS
    OF THE DATA MEASURED BY MOLLER ET AL./3/, RIBON/4/ AND
    KARZHAVINA ET AL./5/  THE AVERAGE RADIATION WIDTH OF 0.121 EV
    WAS ASSUMED.  THE SCATTERING RADIUS WAS TAKEN FROM MUGHABGHAB
    AND GARBER/6/

  UNRESOLVED RESONANCE REGION : 0.3037 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTION S0 WAS BASED ON THE COMPILATION
    OF MUGHABGHAB/7/, AND S1 AND S2 WERE CALCULATED WITH OPTICAL
    MODEL CODE CASTHY/8/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH GG WAS BASED ON THE COMPILATION OF
    MUGHABGHAB.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 1.900E-4, S1 = 1.100E-4, S2 = 2.300E-4, SG = 233.E-4,
    GG = 0.097 EV, R  = 6.881 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                      2200 M/S                RES. INTEG.
      TOTAL       255085                         -
      ELASTIC       1007                         -
      CAPTURE     254078                        763
     (N,ALPHA)          4.775E-04

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/9/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  ADOPTED FROM IIJIMA AND KAWAI/10/, AND WS WAS CHANGED.  THE
  OMP'S FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/11/
     ALPHA    = HUIZENGA AND IGO/12/
     DEUTERON = LOHR AND HAEBERLI/13/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/14/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/15/ WERE EVALUATED BY IIJIMA ET AL./16/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /17/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./18/.

           NO.       ENERGY(MEV)     SPIN-PARITY
           GR.        0.0             3/2 -
            1         0.0545          5/2 -
            2         0.0640          5/2 +
            3         0.1158          7/2 +
            4         0.1315          7/2 -
            5         0.1810          9/2 +
            6         0.2274          9/2 -
            7         0.3460         11/2 -
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            8         0.3600         13/2 +
            9         0.4250         11/2 -
           10         0.4366          5/2 -
           11         0.4772          3/2 +
           12         0.5170          7/2 -
           13         0.5270          5/2 +
           14         0.6170          9/2 -
           15         0.6390         15/2 -
           16         0.6830          3/2 +
           17         0.6850          1/2 +
           18         0.6870          3/2 +
           19         0.7000          3/2 -
           20         0.7040          1/2 -
           21         0.7210          9/2 +
           22         0.7450          3/2 -
           23         0.7510          5/2 -
           24         0.7650          7/2 -
           25         0.7910          5/2 -
           26         0.8100          3/2 -
           27         0.8130          7/2 -
           28         0.8390          5/2 -
      LEVELS ABOVE 0.85 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/19/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (2.23E-02) WAS ADJUSTED TO
    REPRODUCE THE CAPTURE CROSS SECTION OF 560 MILLI-BARNS AT 100
    KEV MEASURED BY SHORIN ET AL./20/ AND BY NAKAJIMA ET AL.
    /21/

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT = 32  (N,N'D) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (= 175.4) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/22/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,2N), (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,2N)      1750.00  MB (SYSTEMATICS OF WEN DEN LU+/23/)
      (N,P)          5.40  MB (RECOMMENDED BY FORREST/24/)
      (N,ALPHA)      1.49  MB (SYSTEMATICS OF FORREST/24/)

    THE (N,ALPHA) CROSS SECTION BELOW 303.7 EV WAS CALCULATED
    FROM RESONANCE PARAMETERS, BY ASSUMING A MEAN ALPHA WIDTH OF
    2.0E-10 EV SO AS TO REPRODUCE THE THERMAL CROSS SECTION/7/.
    THE CROSS SECTION WAS AVERAGED IN SUITABLE ENERGY INTERVALS.
    ABOVE 303.7 EV, THE CROSS SECTION WAS CONNECTED SMOOTHLY TO
    THE PEGASUS CALCULATION.

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY/8/.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

              DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
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       V  = 38.0                     R0 = 7.439    A0 = 0.47
       WS = 8.0                      RS = 7.439    AS = 0.52
       VSO= 7.0                      RSO= 7.439    ASO= 0.47
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.
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TABLE 2 LEVEL DENSITY PARAMETERS

NUCLIDE	SYST	A(1/MEV)	T(MEV)	C(1/MEV)	EX(MEV)	PAIRING
62-SM-153		2.572E+01	5.160E-01	2.101E+01	6.405E+00	1.220E+00
62-SM-154		2.190E+01	5.600E-01	1.960E+00	7.188E+00	2.140E+00
62-SM-155		2.402E+01	5.080E-01	8.478E+00	5.767E+00	1.220E+00
62-SM-156	*	2.260E+01	5.145E-01	1.309E+00	6.251E+00	1.950E+00
63-EU-154		2.267E+01	4.320E-01	1.644E+01	2.784E+00	0.0
63-EU-155		2.083E+01	5.200E-01	5.190E+00	4.837E+00	9.200E-01
63-EU-156		2.084E+01	4.030E-01	6.286E+00	1.992E+00	0.0
63-EU-157		1.975E+01	5.400E-01	6.628E+00	4.704E+00	7.300E-01
64-GD-155		2.500E+01	5.100E-01	2.181E+01	5.822E+00	9.700E-01
64-GD-156		2.254E+01	5.200E-01	1.630E+00	6.286E+00	1.890E+00
64-GD-157		2.278E+01	5.210E-01	1.077E+01	5.454E+00	9.700E-01
64-GD-158		2.155E+01	5.420E-01	2.479E+00	6.260E+00	1.700E+00

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 8.107 FOR GD-157 AND 6.845 FOR GD-158.

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MAT number = 6443

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 64-GD-158 JNDC       EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                      DIST-NOV90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE PARAMETERS FOR MLBW FORMULA (BELOW 6.58 KEV)
    RESONANCE PARAMETERS WERE TAKEN FROM JENDL-2 WHOSE EVALUATION
    WAS MADE AS FOLLOWS:  PARAMETERS WERE MAINLY TAKEN FROM THE
    EXPERIMENTAL DATA OF RAHN ET AL./3/.  THE AVERAGE RADIATIVE
    CAPTURE WIDTH OF 0.088 EV WAS ASSUMED.  A NEGATIVE RESONANCE
    WAS ADDED SO AS TO REPRODUCE THE THERMAL CAPTURE CROSS SECTION
    GIVEN BY MUGHABGHAB AND GARBER/4/.  SCATTERING RADIUS OF 6.5
    FM WAS ADOPTED FROM REF./4/.

  UNRESOLVED RESONANCE REGION : 6.58 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0 AND S2 WERE BASED ON THE
    COMPILATION OF MUGHABGHAB/5/, AND S1 WAS CALCULATED WITH
    OPTICAL MODEL CODE CASTHY/6/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH GG WAS BASED ON THE COMPILATION OF
    MUGHABGHAB.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 1.500E-4, S1 = 1.100E-4, S2 = 1.900E-4, SG = 9.30E-4,
    GG = 0.105 EV, R  = 7.119 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                     2200 M/S               RES. INTEG.
      TOTAL           6.354                    -
      ELASTIC         3.858                    -
      CAPTURE         2.496                   64.0

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/7/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  ADOPTED FROM IIJIMA AND KAWAI/8/, AND WS WAS CHANGED.  THE OMP'S
  FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/9/
     ALPHA    = HUIZENGA AND IGO/10/
     DEUTERON = LOHR AND HAEBERLI/11/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/12/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/13/ WERE EVALUATED BY IIJIMA ET AL./14/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /15/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./16/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0             0  +
            1        0.0795          2  +
            2        0.2614          4  +
            3        0.5390          6  +
            4        0.9771          1  -
            5        1.0237          2  -
            6        1.0416          3  -
            7        1.1590          4  -
            8        1.1760          5  -
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               9        1.1870          2  +
              10        1.1960          0  +
              11        1.2600          2  +
              12        1.2640          1  -
              13        1.2650          3  +
              14        1.3580          4  +
              15        1.3720          6  -
              16        1.3810          4  +
              17        1.4030          3  -
              18        1.4070          4  +
              19        1.4520          0  +
              20        1.5170          2  +
              21        1.6360          4  -
              22        1.6670          4  +
              23        1.7430          0  +
              24        1.7920          2  +
              25        1.7940          2  -
         LEVELS ABOVE 1.85 MEV WERE ASSUMED TO BE OVERLAPPING.

     MT = 102  CAPTURE
       SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
       CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
       SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
       AND REFFO/17/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

       THE GAMMA-RAY STRENGTH FUNCTION (8.02E-4) WAS ADJUSTED TO
       REPRODUCE THE CAPTURE CROSS SECTION OF 250 MILLI-BARNS AT 50
       KEV MEASURED BY KONONOV ET AL./18/ AND SHORIN ET AL./19/

     MT = 16  (N,2N) CROSS SECTION
     MT = 17  (N,3N) CROSS SECTION
     MT = 22  (N,N'A) CROSS SECTION
     MT = 28  (N,N'P) CROSS SECTION
     MT = 32  (N,N'D) CROSS SECTION
     MT =103  (N,P) CROSS SECTION
     MT =104  (N,D) CROSS SECTION
     MT =105  (N,T) CROSS SECTION
     MT =107  (N,ALPHA) CROSS SECTION
       THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
       PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

       THE KALBACH'S CONSTANT K (= 145.5) WAS ESTIMATED BY THE
       FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/20/ AND LEVEL
       DENSITY PARAMETERS.

       FINALLY, THE (N,2N) AND (N,ALPHA) CROSS SECTIONS WERE
       NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
         (N,2N)       1800.00  MB (SYSTEMATICS OF WEN DEN LU+/21/)
         (N,ALPHA)       2.30  MB (MEASURED BY LAKSHMANA+/22/)

     MT = 251  MU-BAR
       CALCULATED WITH CASTHY.

   MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
     LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
     GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
     TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
     CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
     BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

   MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
     ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
     PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
     OTHER NEUTRON EMITTING REACTIONS.

   TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                   DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
            ----------------------   ------------  ---------------
          V  = 38.0                  R0 = 7.439    A0 = 0.47
          WS = 8.0                   RS = 7.439    AS = 0.52
          VSO= 7.0                   RSO= 7.439    ASO= 0.47
     THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

   TABLE 2  LEVEL DENSITY PARAMETERS

    NUCLIDE   SYST  A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
    ---------------------------------------------------------------
    62-SM-154       2.190E+01 5.600E-01 1.960E+00 7.188E+00 2.140E+00
    62-SM-155       2.402E+01 5.080E-01 8.478E+00 5.767E+00 1.220E+00
    62-SM-156   *   2.260E+01 5.145E-01 1.309E+00 6.251E+00 1.950E+00
    62-SM-157   *   2.193E+01 5.121E-01 3.892E+00 5.288E+00 1.220E+00
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63-EU-155		2.083E+01	5.200E-01	5.190E+00	4.837E+00	9.200E-01
63-EU-156		2.084E+01	4.030E-01	6.286E+00	1.992E+00	0.0
63-EU-157		1.975E+01	5.400E-01	6.628E+00	4.704E+00	7.300E-01
63-EU-158	*	2.207E+01	5.096E-01	4.288E+01	4.059E+00	0.0
64-GD-156		2.254E+01	5.200E-01	1.630E+00	6.286E+00	1.890E+00
64-GD-157		2.278E+01	5.210E-01	1.077E+01	5.454E+00	9.700E-01
64-GD-158		2.155E+01	5.420E-01	2.479E+00	6.260E+00	1.700E+00
64-GD-159		2.308E+01	5.160E-01	1.099E+01	5.433E+00	9.700E-01

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 6.845 FOR GD-158 AND 5.0 FOR GD-159.

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MAT number = 6449

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 64-GD-160 JNDC        EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                       DIST-NOV90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE REGION (MLBW FORMULA) : BELOW 4.224 KEV
    RESONANCE PARAMETERS WERE TAKEN FROM JENDL-2.  THE EXPERIMEN-
    TAL DATA OF RAHN ET AL./3/ WERE MAINLY ADOPTED TO JENDL-2.
    THE AVERAGE RADIATION WIDTH WAS ASSUMED TO BE 0.088 EV.  A
    NEGATIVE RESONANCE WAS ADDED SO AS TO REPRODUCE THE THERMAL
    CAPTURE CROSS SECTION GIVEN BY MUGHABGHAB/4,5/.  SCATTERING
    RADIUS OF 6.8 FM WAS BASED ON THE RECOMMENDATION IN REF./4/.

  UNRESOLVED RESONANCE REGION : 4.224 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS S0, S1, S2 WERE BASED ON THE
    COMPILATION OF MUGHABGHAB /5/.  THE OBSERVED LEVEL SPACING WAS
    DETERMINED TO REPRODUCE THE CAPTURE CROSS SECTION CALCULATED
    WITH CASTHY/6/.  THE EFFECTIVE SCATTERING RADIUS WAS OBTAINED
    FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT 100 KEV.
    THE RADIATION WIDTH GG WAS BASED ON THE COMPILATION OF
    MUGHABGHAB.

  TYPICAL VALUES OF THE PARAMETERS AT 70 KEV:
    S0 = 1.600E-4, S1 = 0.500E-4, S2 = 1.300E-4, SG = 4.87E-4,
    GG = 0.111 EV, R  = 7.440 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
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	2200 M/S	RES. INTEG.
TOTAL	4.901	-
ELASTIC	4.105	-
CAPTURE	0.7961	12.0

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MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/7/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  ADOPTED FROM IIJIMA AND KAWAI/8/, AND WS WAS CHANGED.  THE OMP'S
  FOR CHARGED PARTICLES ARE AS FOLLOWS:
     PROTON   = PEREY/9/
     ALPHA    = HUIZENGA AND IGO/10/
     DEUTERON = LOHR AND HAEBERLI/11/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/12/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/13/ WERE EVALUATED BY IIJIMA ET AL./14/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /15/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./16/.
```

NO.	ENERGY(MEV)	SPIN-PARITY
GR.	0.0	0 +
1	0.0753	2 +
2	0.2482	4 +
3	0.5140	6 +
4	0.8680	8 +
5	0.9890	2 +
6	1.0100	2 +
7	1.0580	3 +
8	1.0710	2 +
9	1.1490	4 +
10	1.1850	4 +

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          11        1.2250          1  -
          12        1.2900          3  -
          13        1.4260          5  -
          14        1.4620          3  -
          15        1.5690          1  -
          16        1.6880          3  -
     LEVELS ABOVE 1.97 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/17/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (3.056E-04) WAS ADJUSTED TO
    REPRODUCE THE CAPTURE CROSS SECTION OF 125 MILLI-BARNS AT 70
    KEV MEASURED BY SHORIN ET AL./18/

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT = 32  (N,N'D) CROSS SECTION
  MT = 33  (N,N'T) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (=  50.0) WAS DETERMINED TO REPRODUCE
    ENERGY DEPENDENCE OF THE (N,2N) CROSS SECTION MEASURED BY
    FREHAUT+/19/.

    FINALLY, THE (N,2N) (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,2N)      1700.00  MB (TO REPRODUCE THE DATA MEASURED BY
                                 FREHAUT+/19/)
      (N,P)          1.84  MB (SYSTEMATICS OF FORREST/20/)
      (N,ALPHA)      2.00  MB (RECOMMENDED BY FORREST/20/)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
          ----------------------  ------------  ---------------
        V  = 38.0                 R0 = 7.439    A0 = 0.47
        WS = 8.0                  RS = 7.439    AS = 0.52
        VSO= 7.0                  RSO= 7.439    ASO= 0.47
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2  LEVEL DENSITY PARAMETERS

 NUCLIDE  SYST A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
 ---------------------------------------------------------------
 62-SM-156  *  2.260E+01 5.145E-01 1.309E+00 6.251E+00 1.950E+00
 62-SM-157  *  2.193E+01 5.121E-01 3.892E+00 5.288E+00 1.220E+00
 62-SM-158  *  2.124E+01 5.096E-01 7.103E-01 5.756E+00 1.920E+00
 62-SM-159  *  2.055E+01 5.072E-01 2.026E+00 4.824E+00 1.220E+00

 63-EU-157     1.975E+01 5.400E-01 6.628E+00 4.704E+00 7.300E-01
 63-EU-158  *  2.207E+01 5.096E-01 4.288E+01 4.059E+00 0.0
 63-EU-159  *  2.138E+01 5.072E-01 7.854E+00 4.527E+00 7.000E-01
 63-EU-160  *  2.068E+01 5.048E-01 2.279E+01 3.595E+00 0.0

 64-GD-158     2.155E+01 5.420E-01 2.479E+00 6.260E+00 1.700E+00
 64-GD-159     2.308E+01 5.160E-01 1.099E+01 5.433E+00 9.700E-01
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64-GD-160     2.130E+01 5.150E-01 1.325E+00 5.623E+00 1.670E+00
64-GD-161     2.277E+01 5.000E-01 6.973E+00 5.024E+00 9.700E-01
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 SYST:  * = LDP'S WERE DETERMINED FROM SYSTEMATICS.
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SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3). IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE ASSUMED TO BE 8.875 FOR GD-160 AND 5.0 FOR GD-161.

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MAT number = 6525

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 65-TB-159 JNDC        EVAL-MAR90 JNDC FP NUCLEAR DATA W.G.
                       DIST-NOV90
HISTORY
84-10 EVALUATION FOR JENDL-2 WAS MADE BY JNDC FPND W.G./1/
90-03 MODIFICATION FOR JENDL-3 WAS MADE/2/.

MF = 1  GENERAL INFORMATION
  MT=451 COMMENTS AND DICTIONARY

MF = 2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCE PARAMETERS FOR MLBW FORMULA (BELOW 1.188KEV)
    RESONANCE PARAMETERS WERE BASED ON JENDL-2 AND TOTAL SPIN J
    OF J-UNKNOWN RESONANCES WAS ESTIMATED WITH A RANDOM NUMBER
    METHOD.
       IN THE JENDL-2 EVALUATION, RESONANCE PARAMETERS WERE MAINLY
    TAKEN FROM THE EXPERIMENTAL DATA BY OHKUBO AND KAWARASAKI/3/
    AND BY DERRIEN AND ALIX/4/.  THE AVERAGE RADIATION WIDTH WAS
    ASSUMED TO BE 0.097 EV.  A NEGATIVE RESONANCE WAS ADDED AT
    -0.1 EV SO AS TO REPRODUCE THE CAPTURE CROSS SECTION OF 25.5
    +-1.1 BARNS AND THE ELASTIC SCATTERING OF 20+-2 BARNS AT
    0.0253 EV/5/.  SCATTERING RADIUS OF 8.3 FM WAS TAKEN FROM THE
    RECOMMENDATION BY MUGHABGHAB AND GARBER/5/.

  UNRESOLVED RESONANCE REGION : 1.188 KEV - 100 KEV
    THE NEUTRON STRENGTH FUNCTIONS, S0, S1 AND S2, WERE BASED ON
    THE COMPILATION OF MUGHABGHAB/6/.  THE PARAMETERS WERE
    ADJUSTED TO REPRODUCE THE CAPTURE CROSS SECTION MEASURED BY
    MIZUMOTO ET AL./7,8/  THE EFFECTIVE SCATTERING RADIUS WAS
    OBTAINED FROM FITTING TO THE CALCULATED TOTAL CROSS SECTION AT
    100 KEV.  THE RADIATION WIDTH GG WAS BASED ON THE COMPILATION
    OF MUGHABGHAB.

  TYPICAL VALUES OF THE PARAMETERS AT 80 KEV:
    S0 = 1.207E-4, S1 = 1.480E-4, S2 = 1.090E-4, SG = 537.E-4,
    GG = 0.097 EV, R  = 7.058 FM.

  CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS (BARNS)
                   2200 M/S               RES. INTEG.
      TOTAL        47.39                    -
      ELASTIC      20.87                    -
      CAPTURE      26.52                   471

MF = 3  NEUTRON CROSS SECTIONS
  BELOW 100 KEV, RESONANCE PARAMETERS WERE GIVEN.
  ABOVE 100 KEV, THE SPHERICAL OPTICAL AND STATISTICAL MODEL
  CALCULATION WAS PERFORMED WITH CASTHY/9/, BY TAKING ACCOUNT OF
  COMPETING REACTIONS, OF WHICH CROSS SECTIONS WERE CALCULATED
  WITH PEGASUS/10/ STANDING ON A PREEQUILIBRIUM AND MULTI-STEP
  EVAPORATION MODEL.  THE OMP'S FOR NEUTRON GIVEN IN TABLE 1 WERE
  DETERMINED TO REPRODUCE THE TB-159 TOTAL CROSS SECTION MEASURED
  BY FOSTER AND GLASGOW/11/.  THE OMP'S FOR CHARGED PARTICLES ARE
  AS FOLLOWS:
     PROTON   = PEREY/12/
     ALPHA    = HUIZENGA AND IGO/13/
     DEUTERON = LOHR AND HAEBERLI/14/
     HELIUM-3 AND TRITON = BECCHETTI AND GREENLEES/15/
  PARAMETERS FOR THE COMPOSITE LEVEL DENSITY FORMULA OF GILBERT
  AND CAMERON/16/ WERE EVALUATED BY IIJIMA ET AL./17/  MORE
  EXTENSIVE DETERMINATION AND MODIFICATION WERE MADE IN THE
  PRESENT WORK.  TABLE 2 SHOWS THE LEVEL DENSITY PARAMETERS USED
  IN THE PRESENT CALCULATION.  ENERGY DEPENDENCE OF SPIN CUT-OFF
  PARAMETER IN THE ENERGY RANGE BELOW E-JOINT IS DUE TO GRUPPELAAR
  /18/.

  MT = 1  TOTAL
    SPHERICAL OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT = 2  ELASTIC SCATTERING
    CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT = 4, 51 - 91  INELASTIC SCATTERING
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WAS
    ADOPTED.  THE LEVEL SCHEME WAS TAKEN FROM REF./19/.

           NO.      ENERGY(MEV)    SPIN-PARITY
           GR.       0.0            3/2 +
            1        0.0580         5/2 +
            2        0.1375         7/2 +
            3        0.2414         9/2 +
            4        0.3479         5/2 +
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          5         0.3626         11/2 +
          6         0.3637          5/2 -
          7         0.3895          7/2 -
          8         0.4290          7/2 +
          9         0.4552          9/2 -
         10         0.5106         13/2 +
         11         0.5340          9/2 +
         12         0.5457         11/2 -
         13         0.5483          7/2 -
         14         0.5809          1/2 +
         15         0.6177          3/2 +
         16         0.6690         15/2 +
         17         0.6743          5/2 +
         18         0.6787          9/2 -
         19         0.7613          7/2 +
         20         0.7780          7/2 +
         21         0.8230         11/2 -
         22         0.8550          3/2 -
      LEVELS ABOVE 0.86 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT = 102  CAPTURE
    SPHERICAL OPTICAL AND STATISTICAL MODEL CALCULATION WITH
    CASTHY WAS ADOPTED.  DIRECT AND SEMI-DIRECT CAPTURE CROSS
    SECTIONS WERE ESTIMATED ACCORDING TO THE PROCEDURE OF BENZI
    AND REFFO/20/ AND NORMALIZED TO 1 MILLI-BARN AT 14 MEV.

    THE GAMMA-RAY STRENGTH FUNCTION (3.65E-02) WAS ADJUSTED TO
    REPRODUCE THE CAPTURE CROSS SECTION OF 1050 MILLI-BARNS AT 70
    KEV MEASURED BY MIZUMOTO ET AL./7,8/  THE RESULTS WERE
    MODIFIED BY TAKING ACCOUNT OF THE DATA MEASURED BY BLOCK ET
    AL./21/, GIBBONS ET AL./22/ AND POENITZ/23/.

  MT = 16  (N,2N) CROSS SECTION
  MT = 17  (N,3N) CROSS SECTION
  MT = 22  (N,N'A) CROSS SECTION
  MT = 28  (N,N'P) CROSS SECTION
  MT = 32  (N,N'D) CROSS SECTION
  MT = 33  (N,N'T) CROSS SECTION
  MT =103  (N,P) CROSS SECTION
  MT =104  (N,D) CROSS SECTION
  MT =105  (N,T) CROSS SECTION
  MT =107  (N,ALPHA) CROSS SECTION
    THESE REACTION CROSS SECTIONS WERE CALCULATED WITH THE
    PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS.

    THE KALBACH'S CONSTANT K (= 177.9) WAS ESTIMATED BY THE
    FORMULA DERIVED FROM KIKUCHI-KAWAI'S FORMALISM/24/ AND LEVEL
    DENSITY PARAMETERS.

    FINALLY, THE (N,2N) (N,P) AND (N,ALPHA) CROSS SECTIONS WERE
    NORMALIZED TO THE FOLLOWING VALUES AT 14.5 MEV:
      (N,2N)      1860.00  MB (SYSTEMATICS OF WEN DEN LU+/25/)
      (N,P)          4.70  MB (RECOMMENDED BY FORREST/26/)
      (N,ALPHA)      2.50  MB (RECOMMENDED BY FORREST)

  MT = 251  MU-BAR
    CALCULATED WITH CASTHY.

MF = 4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  LEGENDRE POLYNOMIAL COEFFICIENTS FOR ANGULAR DISTRIBUTIONS ARE
  GIVEN IN THE CENTER-OF-MASS SYSTEM FOR MT=2 AND DISCRETE INELAS-
  TIC LEVELS, AND IN THE LABORATORY SYSTEM FOR MT=91.  THEY WERE
  CALCULATED WITH CASTHY.  FOR OTHER REACTIONS, ISOTROPIC DISTRI-
  BUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF = 5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE CALCULATED WITH
  PEGASUS FOR INELASTIC SCATTERING TO OVERLAPPING LEVELS AND FOR
  OTHER NEUTRON EMITTING REACTIONS.

TABLE 1  NEUTRON OPTICAL POTENTIAL PARAMETERS

                DEPTH (MEV)       RADIUS(FM)    DIFFUSENESS(FM)
         ----------------------   ------------  ---------------
       V  = 40.7-0.016E           R0 = 7.173    A0 = 0.47
       WS = 11.3                  RS = 7.249    AS = 0.47
       VSO= 7.0                   RSO= 7.173    ASO= 0.47
  THE FORM OF SURFACE ABSORPTION PART IS DER. WOODS-SAXON TYPE.

TABLE 2  LEVEL DENSITY PARAMETERS

 NUCLIDE   SYST A(1/MEV)  T(MEV)    C(1/MEV)  EX(MEV)   PAIRING
```

63-EU-155		2.083E+01	5.200E-01	5.190E+00	4.837E+00	9.200E-01
63-EU-156		2.084E+01	4.030E-01	6.286E+00	1.992E+00	0.0
63-EU-157		1.975E+01	5.400E-01	6.628E+00	4.704E+00	7.300E-01
63-EU-158	*	2.207E+01	5.096E-01	4.288E+01	4.059E+00	0.0
64-GD-156		2.254E+01	5.200E-01	1.630E+00	6.286E+00	1.890E+00
64-GD-157		2.278E+01	5.210E-01	1.077E+01	5.454E+00	9.700E-01
64-GD-158		2.155E+01	5.420E-01	2.479E+00	6.260E+00	1.700E+00
64-GD-159		2.308E+01	5.160E-01	1.099E+01	5.433E+00	9.700E-01
65-TB-157	*	2.439E+01	5.121E-01	1.937E+01	5.654E+00	9.200E-01
65-TB-158	*	2.372E+01	5.096E-01	8.443E+01	4.501E+00	0.0
65-TB-159		2.150E+01	5.150E-01	8.937E+00	4.738E+00	7.300E-01
65-TB-160		2.172E+01	4.850E-01	2.558E+01	3.503E+00	0.0

SYST: * = LDP'S WERE DETERMINED FROM SYSTEMATICS.

SPIN CUTOFF PARAMETERS WERE CALCULATED AS 0.146*SQRT(A)*A**(2/3).
IN THE CASTHY CALCULATION, SPIN CUTOFF FACTORS AT 0 MEV WERE
ASSUMED TO BE 10.5 FOR TB-159 AND 5.0 FOR TB-160.

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MAT number = 7200

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 72-HF-  0 NAIG+       EVAL-JUL89 HIDA, YOSHIDA AND SHIBATA(JAERI)
                       DIST-SEP89 REV2-JAN94
HISTORY
89-07 NEW EVALUATION FOR JENDL-3 WAS MADE BY K.HIDA, T.YOSHIDA
      (NAIG) AND K.SHIBATA (JAERI).
94-01 JENDL-3.2.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (3,2), (3,3), (3,4), (3,51-54),(3,58-62), (3,66-68)
      (3,70-74), (3,76-78)
                    CURVES OF INELASTIC SCATTERING CROSS SECTIONS
                    WERE SMOOTHED BY ADDING INTERPOLATED VALUES AT
                    SEVERAL ENERGY POINTS.
      (3,102)       Q-VALUE WAS CHANGED.
      (12,102)      MODIFIED.
     ***********************************************************


MF=1  GENERAL INFORMATION
 MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
 MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESONANCE REGION: 1.0E-5 EV TO 50 KEV
  RESOLVED RESONANCES FOR MLBW FORMULA
   MADE UP OF ISOTOPIC FILES.
  UNRESOLVED RESONANCES
   MADE UP OF ISOTOPIC FILES.

      2200 M/SEC CROSS SECTIONS AND CALCULATED RES. INTEGRALS.
                    2200 M/SEC    RES. INTEG.
          TOTAL     114.9 B          -
          ELASTIC     9.9 B          -
          CAPTURE   105.0 B       1996. B

MF=3  NEUTRON CROSS SECTIONS
BELOW 50 KEV :
 NO BACKGROUND WAS GIVEN.
ABOVE 50 KEV :
 MT=1     TOTAL
  50 KEV - 110 KEV : MADE UP OF ISOTOPIC FILES.
  110 KEV - 7.5 MEV: SPLINE-FUNCTION FITTING TO THE EXPERIMENTAL
                     DATA/1,2,3/.
  7.5 MEV - 20 MEV : MADE UP OF ISOTOPIC FILES.
 MT=2     ELASTIC
  OBTAINED BY SUBTRACTING A SUM OF PARTIAL REACTION CROSS SECTIONS
  FROM THE TOTAL CROSS SECTION.
 MT=3     NONELASTIC
  SUM OF MT=4, 16, 17, 102, 103, 107.
 MT=4     TOTAL INELASTIC
  SUM OF MT=51-79, 91.
 MT=51-79, 91    INELASTIC
  MADE UP OF ISOTOPIC FILES.
  THE DISCRETE LEVELS WERE LUMPED.
 MT=16,17,102,103,107  (N,2N),(N,3N),(N,GAMMA),(N,P),(N,ALPHA)
  MADE UP OF ISOTOPIC FILES.
 MT=251  MU-BAR
  CALCULATED FROM MF/MT=4/2.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=2,51-79,91
  MADE UP OF ISOTOPIC FILES.
 MT=16,17
  ISOTROPIC IN THE LABORATORY SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=16,17,91
  MADE UP OF ISOTOPIC FILES.

MF=12 PHOTON PRODUCTION MULTIPLICITIES
 MT=3,102
  MADE UP OF ISOTOPIC FILES.

MF=14 PHOTON ANGULAR DISTRIBUTIONS
 MT=3,102
  ISOTROPIC.

MF=15 CONTINUOUS PHOTON ENERGY SPECTRA
 MT=3,102
  MADE UP OF ISOTOPIC FILES.
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MAT number = 7225
 72-HF-174 NAIG+      EVAL-JUL89 HIDA, YOSHIDA AND SHIBATA(JAERI)
                      DIST-SEP89 REV2-JAN94
HISTORY
89-07 NEW EVALUATION FOR JENDL-3 WAS MADE BY K.HIDA, T.YOSHIDA
      (NAIG) AND K.SHIBATA (JAERI).
94-01 JENDL-3.2.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (3,2), (3,4), (3,51), (3,52), (3,55-63), (3,65-68)
                    CURVES OF INELASTIC SCATTERING CROSS SECTIONS
                    WERE SMOOTHED BY ADDING INTERPOLATED VALUES AT
                    SEVERAL ENERGY POINTS.
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MF=1  GENERAL INFORMATION
 MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
 MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
 RESOLVED RESONANCES FOR MLBW FORMULA
    ENERGY RANGE            : 1.0E-5 EV TO 220 EV.
    RES. ENERGIES AND GAM-N : BNL-325 /1/.
    GAM-GAMMA               : 0.060 EV ASSUMED IF UNKNOWN.
    RADIUS                  : 7.5 FM
 UNRESOLVED RESONANCES
    ENERGY RANGE            : 220 EV TO 50 KEV.
    S0, S1, R AND GAM-GAMMA : ADJUSTED SO THAT THE CALCULATED
                              TOTAL AND CAPTURE CROSS SECTIONS
                              WERE REPRODUCED WELL.
    RESULTS ARE D-OBS = 13.4 EV, S0 = 2.8E-4, S1 = 1.00E-4,
    R = 7.9 FM AND GAM-GAMMA = 0.054 EV.

    2200 M/SEC CROSS SECTIONS AND CALCULATED RES. INTEGRALS.
                  2200 M/SEC    RES. INTEG.
        TOTAL      576.4 B          -
        ELASTIC     15.0 B          -
        CAPTURE    561.5 B       363.8 B

MF=3  NEUTRON CROSS SECTIONS
BELOW 50 KEV :
 NO BACKGROUND WAS GIVEN.
ABOVE 50 KEV :
 MT=1,2,4,51-68,91,102  TOTAL,ELASTIC,INELASTIC AND CAPTURE
  CALCULATED WITH ECIS /2/ AND CASTHY /3/.  DEFORMED OPTICAL
  POTENTIAL FOR ECIS CALCULATION WAS DETERMINED SO AS TO REPRODUCE
  THE EXPERIMENTAL TOTAL CROSS SECTION OF NATURAL HAFNIUM,
  STARTING WITH THE HAOUAT POTENTIAL /4/.
     V0 = 47.05-0.3*EN, WS = 3.92+0.4*EN (EN<10), VSO = 6.2 (MEV),
                             7.92        (EN>10)
     A0 = 0.63,         AS = 0.52,                ASO = 0.47 (FM),
     R0 = 1.24,         RS = 1.24,                RSO = 1.12 (FM),
     BETA-2 = 0.266,    BETA-4 = 0.0.
  THE DEFORMATION PARAMETER BETA-2 WAS DETERMINED FROM THE
  MEASURED E2 TRANSITION PROBABILITY DATA /5/.  THE LOWEST THREE
  LEVELS BELONGING TO THE GROUND STATE ROTATIONAL BAND WERE
  COUPLED IN THE CALCULATION.  THE SPHERICAL OPTICAL POTENTIAL FOR
  CASTHY CALCULATION IS THE SAME AS THAT OF JENDL-2.
     V0 = 38.0, WS = 8.0+0.5*SQRT(EN), VSO = 7.0 (MEV),
     A0 = 0.47, AS = 0.52            , ASO = 0.47 (FM),
     R0 = 1.32, RS = 1.32            , RSO = 1.32 (FM).
  COMPETING PROCESSES (N,2N) AND (N,3N) WERE CALCULATED WITH GNASH
  /6/ AND FED TO ECIS-CASTHY CALCULATION.  THE LEVEL FLUCTUATION
  AND INTERFERENCE EFFECTS WERE CONSIDERED.  LEVEL SCHEME WAS
  TAKEN FROM TABLE OF ISOTOPES /7/.
         NO.     ENERGY(MEV)   SPIN-PARITY
         G.S.     0.0            0 +
           1      0.0910         2 +
           2      0.2975         4 +
           3      0.6084         6 +
           4      0.8282         0 +
           5      0.9002         2 +
           6      1.0622         4 +
           7      1.2268         2 +
           8      1.3034         3 +
           9      1.3087         2 -
          10      1.3194         2 +
          11      1.3365         3 +
          12      1.3947         4 +
          13      1.4253         4 -
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         14       1.4429          5 -
         15       1.4489          4 +
         16       1.4964          2 +
         17       1.5034          3 +
         18       1.6261          4 +
     CONTINUUM LEVELS ASSUMED ABOVE 1.6487 MEV.
   THE LEVEL DENSITY PARAMETERS FOR GILBERT AND CAMERON'S FORMULA
   /8/ ARE THE SAME AS THOSE OF JENDL-2.
                 A(1/MEV)   C(1/MEV)  T(MEV)   EX(MEV)  SIGMA**2
         HF-174    23.09      2.31     0.477     5.01     7.47
         HF-175    22.93     10.0      0.484     4.42     6.00

  MT=16,17          (N,2N), (N,3N)
   CALCULATED WITH GNASH /6/. THE TRANSMISSION COEFFICIENTS FOR THE
   INCIDENT CHANNEL WERE GENERATED WITH ECIS /4/, WHILE THOSE FOR
   THE EXIT CHANNELS WITH ELIESE-3 /9/.  THE PREEQUILIBRIUM PARAME-
   TER F2 WAS ADJUSTED TO REPRODUCE THE MEASURED (N,2N) CROSS
   SECTION AT 14.5 MEV AND RESULTED IN F2=5.0.

  MT=251  MU-BAR
   CALCULATED WITH ECIS /2/ AND CASTHY /3/.

 MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,51-68,91
   CALCULATED WITH ECIS /2/ AND CASTHY /3/.
  MT=16,17
   ISOTROPIC IN THE LABORATORY SYSTEM.

 MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,91
   CALCULATED WITH GNASH /6/.

 MF=12 PHOTON MULTIPLICITIES AND TRANSITION PROBABILITIES
  MT=16,17,91,102
   CALCULATED WITH GNASH /6/ AND STORED UNDER OPTION-1 (PHOTON
   PRODUCTION MULTIPLICITIES).  THE PHOTON STRENGTH FUNCTIONS FOR
   MOST NUCLEI WERE TAKEN FROM /1/, WHILE THOSE FOR SOME HAFNIUM
   ISOTOPES WERE DETERMINED FROM CAPTURE CROSS SECTION NORMALIZA-
   TION TO THE EXPERIMENTAL DATA.  THE PHOTON PROFILE FUNCTION IS A
   SUPERPOSITION OF THE BERMAN-TYPE GIANT DIPOLE RESONANCE /10/ AND
   THE PYGMY RESONANCE WHOSE PARAMETER VALUES WERE CITED FROM THE
   NEIGHBOURING NUCLEUS TA /11/.
         EG1 = 15.23,   EG2 = 12.3 ,   EP = 5.2 (MEV),
         GG1 =  4.48,   GG2 =  2.43,   GP = 2.5 (MEV),
         SIG-PYGMY/SIG-GDR = 0.0245.

  MT=51-68
   STORED UNDER OPTION-2 (TRANSITION PROBABILITY ARRAY).  DATA WERE
   TAKEN FROM /7/.

 MF=14 PHOTON ANGULAR DISTRIBUTIONS
  MT=16,17,51-68,91,102
   ISOTROPIC.

 MF=15 CONTINUOUS PHOTON ENERGY SPECTRA
  MT=16,17,91,102
   CALCULATED WITH GNASH /6/.
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MAT number = 7231
 72-HF-176 NAIG+      EVAL-JUL89 HIDA, YOSHIDA AND SHIBATA(JAERI)
                      DIST-SEP89 REV2-JAN94
HISTORY
89-07 NEW EVALUATION FOR JENDL-3 WAS MADE BY K.HIDA, T.YOSHIDA
      (NAIG) AND K.SHIBATA (JAERI).
94-01 JENDL-3.2.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (3,2), (3,4), (3,51), (3,55-73)
                   CURVES OF INELASTIC SCATTERING CROSS SECTIONS
                   WERE SMOOTHED BY ADDING INTERPOLATED VALUES AT
                   SEVERAL ENERGY POINTS.
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MF=1  GENERAL INFORMATION
 MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
 MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCES FOR MLBW FORMULA
   ENERGY RANGE             : 1.0E-5 EV TO 700 EV.
   RES. ENERGIES AND GAM-N : BNL-325 /1/.
   GAM-GAMMA                : 0.060 EV ASSUMED IF UNKNOWN.
   RADIUS                   : 7.6 FM
  UNRESOLVED RESONANCES
   ENERGY RANGE             : 700 EV TO 50 KEV.
   S0, S1, R AND GAM-GAMMA : ADJUSTED SO THAT THE CALCULATED TOTAL
                              AND CAPTURE CROSS SECTIONS WERE
                              REPRODUCED WELL.
   RESULTS ARE D-OBS = 55.2 EV, S0 = 2.00E-4, S1 = 1.00E-4,
   R = 9.1 FM AND GAM-GAMMA = 0.054 EV.

      2200 M/SEC CROSS SECTIONS AND CALCULATED RES. INTEGRALS.
                    2200 M/SEC    RES. INTEG.
          TOTAL       29.03 B         -
          ELASTIC      5.54 B         -
          CAPTURE     23.48 B      894.1 B

MF=3  NEUTRON CROSS SECTIONS
BELOW 50 KEV :
 NO BACKGROUND WAS GIVEN.
ABOVE 50 KEV :
 MT=1,2,4,51-73,91,102  TOTAL,ELASTIC,INELASTIC AND CAPTURE
  CALCULATED WITH ECIS /2/ AND CASTHY /3/.  DEFORMED OPTICAL
  POTENTIAL FOR ECIS CALCULATION WAS DETERMINED SO AS TO REPRODUCE
  THE EXPERIMENTAL TOTAL CROSS SECTION OF NATURAL HAFNIUM,
  STARTING WITH THE HAOUAT POTENTIAL /4/.
    V0 = 46.89-0.3*EN, WS = 3.84+0.4*EN (EN<10), VSO = 6.2 (MEV),
                          = 7.84       (EN>10)
     A0 = 0.63,         AS = 0.52,                 ASO = 0.47 (FM),
     R0 = 1.24,         RS = 1.24,                 RSO = 1.12 (FM),
     BETA-2 = 0.276,    BETA-4 = 0.0.
  THE DEFORMATION PARAMETER BETA-2 WAS DETERMINED FROM THE
  MEASURED E2 TRANSITION PROBABILITY DATA /5/.  THE LOWEST THREE
  LEVELS BELONGING TO THE GROUND STATE ROTATIONAL BAND WERE
  COUPLED IN THE CALCULATION.  THE SPHERICAL OPTICAL POTENTIAL FOR
  CASTHY CALCULATION IS THE SAME AS THAT OF JENDL-2.
         V0 = 38.0, WS = 8.0+0.5*SQRT(EN), VSO = 7.0 (MEV),
         A0 = 0.47, AS = 0.52            , ASO = 0.47 (FM),
         R0 = 1.32, RS = 1.32            , RSO = 1.32 (FM).
  CAPTURE CROSS SECTION WAS NORMALIZED TO THE MEASURED DATA OF
  BEER ET AL. /6/ AT 30 KEV.  COMPETING PROCESSES (N,2N), (N,3N),
  (N,P), AND (N,ALPHA) WERE CALCULATED WITH GNASH /7/ AND FED TO
  ECIS-CASTHY CALCULATION.  THE LEVEL FLUCTUATION AND INTERFERENCE
  EFFECTS WERE CONSIDERED.  LEVEL SCHEME WAS TAKEN FROM TABLE OF
  ISOTOPES /8/.
         NO.    ENERGY(MEV)   SPIN-PARITY
         G.S.    0.0            0 +
          1      0.0883         2 +
          2      0.2902         4 +
          3      0.5970         6 +
          4      0.9980         8 +
          5      1.1499         0 +
          6      1.2266         2 +
          7      1.2477         2 -
          8      1.2932         0 +
          9      1.3133         3 -
         10      1.3413         2 +
         11      1.3794         2 +
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        12      1.4046          4 -
        13      1.4458          3 +
        14      1.5777          3 +
        15      1.6434          1 -
        16      1.6723          1 +
        17      1.7046          2 +
        18      1.7102          3 -
        19      1.7221          1 -
        20      1.7675          2 -
        21      1.7861          3 +
        22      1.7937          3 -
        23      1.8190          0 -
   CONTINUUM LEVELS ASSUMED ABOVE 1.8400 MEV.
  THE LEVEL DENSITY PARAMETERS FOR GILBERT AND CAMERON'S FORMULA
  /9/ ARE THE SAME AS THOSE OF JENDL-2.
                A(1/MEV)   C(1/MEV)  T(MEV)   EX(MEV)  SIGMA**2
        HF-176    22.77      1.74     0.454     4.38     6.09
        HF-177    22.61      9.06     0.486     4.38     9.45

 MT=16,17,103,107  (N,2N), (N,3N), (N,P) AND (N,ALPHA)
  CALCULATED WITH GNASH /7/. THE TRANSMISSION COEFFICIENTS FOR
  THE INCIDENT CHANNEL WERE GENERATED WITH ECIS /2/, WHILE THOSE
  FOR THE EXIT CHANNELS WITH ELIESE-3 /10/.  THE PREEQUILIBRIUM
  PARAMETER F2 WAS ADJUSTED TO REPRODUCE THE MEASURED (N,2N) CROSS
  SECTION AT 14.5 MEV AND RESULTED IN F2=5.0.

 MT=251  MU-BAR
  CALCULATED WITH ECIS /2/ AND CASTHY /3/.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=2,51-73,91
  CALCULATED WITH ECIS /2/ AND CASTHY /3/.
 MT=16,17
  ISOTROPIC IN THE LABORATORY SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=16,17,91
  CALCULATED WITH GNASH /7/.

MF=12 PHOTON MULTIPLICITIES AND TRANSITION PROBABILITIESP
 MT=16,17,91,102,103,107
  CALCULATED WITH GNASH /7/ AND STORED UNDER OPTION-1 (PHOTON
  PRODUCTION MULTIPLICITIES).  THE PHOTON STRENGTH FUNCTIONS FOR
  MOST NUCLEI WERE TAKEN FROM /1/, WHILE THOSE FOR SOME HAFNIUM
  ISOTOPES WERE DETERMINED FROM CAPTURE CROSS SECTION NORMALIZA-
  TION TO THE EXPERIMENTAL DATA.  THE PHOTON PROFILE FUNCTION IS A
  SUPERPOSITION OF THE BERMAN-TYPE GIANT DIPOLE RESONANCE /11/
  AND THE PYGMY RESONANCE WHOSE PARAMETER VALUES WERE CITED FROM
  THE NEIGHBOURING NUCLEUS TA /12/.
        EG1 = 15.23,   EG2 = 12.3 ,   EP = 5.2 (MEV),
        GG1 =  4.48,   GG2 =  2.43,   GP = 2.5 (MEV),
        SIG-PYGMY/SIG-GDR = 0.0245.

 MT=51-73
  STORED UNDER OPTION-2 (TRANSITION PROBABILITY ARRAY).  DATA WERE
  TAKEN FROM /8/.

MF=14 PHOTON ANGULAR DISTRIBUTIONS
 MT=16,17,51-68,91,102,103,107
  ISOTROPIC.

MF=15 CONTINUOUS PHOTON ENERGY SPECTRA
 MT=16,17,91,102,103,107
  CALCULATED WITH GNASH /7/.

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12) IGASHIRA M. ET AL.: INT. SYMP. CAPTURE GAMMA-RAY SPECROSCOPY
    AND RELATED TOPICS - 1984, 523 (1985).
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MAT number = 7234

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 72-HF-177 NAIG+      EVAL-JUL89 HIDA, YOSHIDA AND SHIBATA(JAERI)
                      DIST-SEP89 REV2-JAN94
HISTORY
89-07 NEW EVALUATION FOR JENDL-3 WAS MADE BY K.HIDA, T.YOSHIDA
      (NAIG) AND K.SHIBATA (JAERI).
94-01 JENDL-3.2.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (3,2), (3,4), (3,51-57), (3,59), (3,61), (3,62-65)
                    CURVES OF INELASTIC SCATTERING CROSS SECTIONS
                    WERE SMOOTHED BY ADDING INTERPOLATED VALUES AT
                    SEVERAL ENERGY POINTS.
     ***********************************************************


MF=1  GENERAL INFORMATION
 MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
 MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCES FOR MLBW FORMULA
   ENERGY RANGE             : 1.0E-5 EV TO 250 EV.
   RES. ENERGIES AND GAM-N  : BNL-325 /1/.
   GAM-GAMMA                : 0.065 EV ASSUMED IF UNKNOWN.
   RADIUS                   : 7.0 FM
  UNRESOLVED RESONANCES
   ENERGY RANGE             : 250 EV TO 50 KEV.
   S0, S1, R AND GAM-GAMMA  : ADJUSTED SO THAT THE CALCULATED TOTAL
                              AND CAPTURE CROSS SECTIONS WERE
                              REPRODUCED WELL.
   RESULTS ARE D-OBS = 3.58 EV, S0 = 2.50E-4, S1 = 1.00E-4,
   R = 7.3 FM AND GAM-GAMMA = 0.065 EV.

      2200 M/SEC CROSS SECTIONS AND CALCULATED RES. INTEGRALS.
                    2200 M/SEC    RES. INTEG.
          TOTAL      373.7 B          -
          ELASTIC      0.2 B          -
          CAPTURE    373.5 B        7210. B

MF=3  NEUTRON CROSS SECTIONS
BELOW 50 KEV :
 NO BACKGROUND WAS GIVEN.
ABOVE 50 KEV :
 MT=1,2,4,51-66,91,102  TOTAL,ELASTIC,INELASTIC AND CAPTURE
  CALCULATED WITH ECIS /2/ AND CASTHY /3/.  DEFORMED OPTICAL
  POTENTIAL FOR ECIS CALCULATION WAS DETERMINED SO AS TO
  REPRODUCE THE EXPERIMENTAL TOTAL CROSS SECTION OF NATURAL
  HAFNIUM, STARTING WITH THE HAOUAT POTENTIAL /4/.
     V0 = 46.82-0.3*EN, WS = 3.81+0.4*EN (EN<10), VSO = 6.2 (MEV),
                             7.81        (EN>10)
     A0 = 0.63,         AS = 0.52,                ASO = 0.47 (FM),
     R0 = 1.24,         RS = 1.24,                RSO = 1.12 (FM),
     BETA-2 = 0.273,    BETA-4 = 0.0.
  THE DEFORMATION PARAMETER BETA-2 WAS DETERMINED FROM THE
  MEASURED E2 TRANSITION PROBABILITY DATA /5/.  THE LOWEST THREE
  LEVELS BELONGING TO THE GROUND STATE ROTATIONAL BAND WERE
  COUPLED IN THE CALCULATION.  THE SPHERICAL OPTICAL POTENTIAL
  FOR CASTHY CALCULATION IS THE SAME AS THAT OF JENDL-2.
     V0 = 38.0, WS = 8.0+0.5*SQRT(EN), VSO = 7.0 (MEV),
     A0 = 0.47, AS = 0.52            , ASO = 0.47 (FM),
     R0 = 1.32, RS = 1.32            , RSO = 1.32 (FM).
  CAPTURE CROSS SECTION WAS NORMALIZED TO THE MEASURED DATA OF
  BEER ET AL. /6/ AT 30 KEV.  COMPETING PROCESSES (N,2N), (N,3N),
  (N,P), AND (N,ALPHA) WERE CALCULATED WITH GNASH /7/ AND FED TO
  ECIS-CASTHY CALCULATION.  THE LEVEL FLUCTUATION AND INTERFERENCE
  EFFECTS WERE CONSIDERED.  LEVEL SCHEME WAS TAKEN FROM TABLE OF
  ISOTOPES /8/.
         NO.     ENERGY(MEV)   SPIN-PARITY
         G.S.     0.0            7/2 -
          1       0.1130         9/2 -
          2       0.2497        11/2 -
          3       0.3213         9/2 +
          4       0.4095        13/2 -
          5       0.4267        11/2 +
          6       0.5081         5/2 -
          7       0.5552        13/2 +
          8       0.5913        15/2 -
          9       0.6044         7/2 -
         10       0.7085        15/2 +
         11       0.7459         7/2 +
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         12      0.7945         17/2 -
         13      0.8057          3/2 -
         14      0.8474          9/2 +
         15      0.8730          5/2 -
         16      0.8828         17/2 +
     CONTINUUM LEVELS ASSUMED ABOVE 0.9480 MEV.
   THE LEVEL DENSITY PARAMETERS FOR GILBERT AND CAMERON'S FORMULA
   /9/ ARE THE SAME AS THOSE OF JENDL-2.
                 A(1/MEV)   C(1/MEV)  T(MEV)   EX(MEV)  SIGMA**2
         HF-177    22.61      9.06     0.486     4.38     9.45
         HF-178    22.36      2.22     0.451     4.08    12.94

  MT=16,17,103,107  (N,2N), (N,3N), (N,P) AND (N,ALPHA)
   CALCULATED WITH GNASH /7/. THE TRANSMISSION COEFFICIENTS FOR
   THE INCIDENT CHANNEL WERE GENERATED WITH ECIS /2/, WHILE THOSE
   FOR THE EXIT CHANNELS WITH ELIESE-3 /10/.  THE PREEQUILIBRIUM
   PARAMETER F2 WAS F2=5.0.

  MT=251  MU-BAR
   CALCULATED WITH ECIS /2/ AND CASTHY /3/.

 MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,51-66,91
   CALCULATED WITH ECIS /2/ AND CASTHY /3/.
  MT=16,17
   ISOTROPIC IN THE LABORATRY SYSTEM.

 MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,91
   CALCULATED WITH GNASH /7/.

 MF=12 PHOTON MULTIPLICITIES AND TRANSITION PROBABILITIES
  MT=16,17,91,102,103,107
   CALCULATED WITH GNASH /7/ AND STORED UNDER OPTION-1 (PHOTON
   PRODUCTION MULTIPLICITIES).  THE PHOTON STRENGTH FUNCTIONS FOR
   MOST NUCLEI WERE TAKEN FROM /1/, WHILE THOSE FOR SOME HAFNIUM
   ISOTOPES WERE DETERMINED FROM CAPTURE CROSS SECTION NORMALIZA-
   TION TO THE EXPERIMENTAL DATA.  THE PHOTON PROFILE FUNCTION IS A
   SUPERPOSITION OF THE BERMAN-TYPE GIANT DIPOLE RESONANCE /11/
   AND THE PYGMY RESONANCE WHOSE PARAMETER VALUES WERE CITED FROM
   THE NEIGHBOURING NUCLEUS TA /12/.
         EG1 = 15.23,   EG2 = 12.3 ,   EP = 5.2 (MEV),
         GG1 =  4.48,   GG2 =  2.43,   GP = 2.5 (MEV),
         SIG-PYGMY/SIG-GDR = 0.0245.

  MT=51-66
   STORED UNDER OPTION-2 (TRANSITION PROBABILITY ARRAY).  DATA WERE
   TAKEN FROM /8/.

 MF=14 PHOTON ANGULAR DISTRIBUTIONS
  MT=16,17,51-66,91,102,103,107
   ISOTROPIC.

 MF=15 CONTINUOUS PHOTON ENERGY SPECTRA
  MT=16,17,91,102,103,107
   CALCULATED WITH GNASH /7/.

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  1) MUGHABGHAB S.F.: NEUTRON CROSS SECTIONS, VOL.1, PART B (1984).
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  3) IGARASI S. AND FUKAHORI T.: JAERI 1321 (1991).
  4) HAOUAT G. ET AL.: NUCL. SCI. ENG., 81, 491 (1982).
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     AND RELATED TOPICS - 1984, 523 (1985).
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MAT number = 7237
 72-HF-178 NAIG+      EVAL-JUL89 HIDA, YOSHIDA AND SHIBATA(JAERI)
                      DIST-SEP89 REV2-JAN94
HISTORY
89-07 NEW EVALUATION FOR JENDL-3 WAS MADE BY K.HIDA, T.YOSHIDA
      (NAIG) AND K.SHIBATA (JAERI).
94-01 JENDL-3.2.
       GAMMA-RAY PRODUCTION DATA: MODIFIED BY K. SHIBATA (JAERI)
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (3,2), (3,4), (3,51-52), (3,56-62), (3,64-65), (3,67-70)
                  CURVES OF INELASTIC SCATTERING CROSS SECTIONS
                  WERE SMOOTHED BY ADDING INTERPOLATED VALUES AT
                  SEVERAL ENERGY POINTS.
      (12,56-71), (14,56-71)
                  TRANSITION PROBABILITIES AND ANG. DISTS. ADDED.
      (12,91), (15,91)
                  NEW CALCULATION WITH GNASH.
     ***********************************************************


MF=1  GENERAL INFORMATION
 MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
 MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCES FOR MLBW FORMULA
   ENERGY RANGE             : 0.5 EV TO 1.5 KEV
   RES. ENERGIES AND GAM-N : BNL-325 /1/.
   GAM-GAMMA                : 0.054 EV ASSUMED IF UNKNOWN.
   RADIUS                   : 7.5 FM
  UNRESOLVED RESONANCES
   ENERGY RANGE             : 1.5 KEV TO 50 KEV.
   S0, S1, R AND GAM-GAMMA : ADJUSTED SO THAT THE CALCULATED TOTAL
                              AND CAPTURE CROSS SECTION WERE
                              REPRODUCED WELL.
   RESULTS ARE D-OBS = 89.9 EV, S0 = 2.20E-4, S1 = 0.51E-4,
   R = 8.5 M AND GAM-GAMMA = 0.054 EV.

      2200 M/SEC CROSS SECTIONS AND CALCULATED RES. INTEGRALS.
                   2200 M/SEC    RES. INTEG.
          TOTAL      88.49 B          -
          ELASTIC     4.46 B          -
          CAPTURE    84.03 B       1916 B

MF=3  NEUTRON CROSS SECTIONS
BELOW 50 KEV :
   NO BACKGROUND WAS GIVEN.
ABOVE 50 KEV :
 MT=1,2,4,51-71,91,102  TOTAL,ELASTIC,INELASTIC AND CAPTURE
  CALCULATED WITH ECIS /2/ AND CASTHY /3/.  DEFORMED OPTICAL
  POTENTIAL FOR ECIS CALCULATION WAS DETERMINED SO AS TO
  REPRODUCE THE EXPERIMENTAL TOTAL CROSS SECTION OF NATURAL
  HAFNIUM, STARTING WITH THE HAOUAT POTENTIAL /4/.
     V0 = 46.74-0.3*EN, WS = 3.77+0.4*EN (EN<10), VSO = 6.2 (MEV),
                             7.77        (EN>10)
     A0 = 0.63,         AS = 0.52,                ASO = 0.47 (FM),
     R0 = 1.24,         RS = 1.24,                RSO = 1.12 (FM),
         BETA-2 = 0.262,    BETA-4 = 0.0.
  THE DEFORMATION PARAMETER BETA-2 WAS DETERMINED FROM THE
  MEASURED E2 TRANSITION PROBABILITY DATA /5/.  THE LOWEST THREE
  LEVELS BELONGING TO THE GROUND STATE ROTATIONAL BAND WERE
  COUPLED IN THE CALCULATION.  THE SPHERICAL OPTICAL POTENTIAL FOR
  CASTHY CALCULATION IS THE SAME AS THAT OF JENDL-2.
     V0 = 38.0, WS = 8.0+0.5*SQRT(EN), VSO = 7.0 (MEV),
     A0 = 0.47, AS = 0.52            , ASO = 0.47 (FM),
     R0 = 1.32, RS = 1.32            , RSO = 1.32 (FM).
  CAPTURE CROSS SECTION WAS NORMALIZED TO THE MEASURED DATA OF
  BEER ET AL. /6/ AT 30 KEV.  COMPETING PROCESSES (N,2N), (N,3N),
  (N,P), AND (N,ALPHA) WERE CALCULATED WITH GNASH /7/ AND FED TO
  ECIS-CASTHY CALCULATION.  THE LEVEL FLUCTUATION AND INTERFERENCE
  EFFECTS WERE CONSIDERED.  LEVEL SCHEME WAS TAKEN FROM TABLE OF
  ISOTOPES /8/.
         NO.    ENERGY(MEV)   SPIN-PARITY
         G.S.    0.0            0 +
          1      0.0932         2 +
          2      0.3066         4 +
          3      0.6322         6 +
          4      1.0585         8 +
          5      1.1474         8 -
          6      1.1746         2 +
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7	1.1993	0 +
8	1.2602	2 -
9	1.2766	2 +
10	1.3099	1 -
11	1.3224	3 -
12	1.3624	2 -
13	1.3641	9 -
14	1.4340	0 +
15	1.4438	0 +
16	1.4790	8 -
17	1.4961	2 +
18	1.5136	1 -
19	1.5613	2 +
20	1.5665	1 -
21	1.6015	10 -

CONTINUUM LEVELS ASSUMED ABOVE 1.6400 MEV.
THE LEVEL DENSITY PARAMETERS FOR GILBERT AND CAMERON'S FORMULA /9/ ARE THE SAME AS THOSE OF JENDL-2.

	A(1/MEV)	C(1/MEV)	T(MEV)	EX(MEV)	SIGMA**2
HF-178	22.36	2.22	0.451	4.08	12.94
HF-179	22.57	6.88	0.465	3.98	9.31

MT=16,17,103,107 (N,2N), (N,3N), (N,P) AND (N,ALPHA)
CALCULATED WITH GNASH /7/. THE TRANSMISSION COEFFICIENTS FOR THE INCIDENT CHANNEL WERE GENERATED WITH ECIS /2/, WHILE THOSE FOR THE EXIT CHANNELS WITH ELIESE-3 /10/. THE PREEQUILIBRIUM PARAMETER F2 WAS F2=5.0.

MT=251 MU-BAR
CALCULATED WITH ECIS /2/ AND CASTHY /3/.

MF=4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=2,51-71,91
CALCULATED WITH ECIS /2/ AND CASTHY /3/.
MT=16,17
ISOTROPIC IN THE LABORATORY SYSTEM.

MF=5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=16,17,91
CALCULATED WITH GNASH /7/.

MF=12 PHOTON MULTIPLICITIES AND TRANSITION PROBABILITIES
MT=16,17,91,102,103,107
CALCULATED WITH GNASH /7/ AND STORED UNDER OPTION-1 (PHOTON PRODUCTION MULTIPLICITIES). THE PHOTON STRENGTH FUNCTIONS FOR MOST NUCLEI WERE TAKEN FROM /1/, WHILE THOSE FOR SOME HAFNIUM ISOTOPES WERE DETERMINED FROM CAPTURE CROSS SECTION NORMALIZATION TO THE EXPERIMENTAL DATA. THE PHOTON PROFILE FUNCTION IS A SUPERPOSITION OF THE BERMAN-TYPE GIANT DIPOLE RESONANCE /11/ AND THE PYGMY RESONANCE WHOSE PARAMETER VALUES WERE CITED FROM THE NEIGHBOURING NUCLEUS TA /12/.

EG1 = 15.23, EG2 = 12.3 , EP = 5.2 (MEV),
GG1 = 4.48, GG2 = 2.43, GP = 2.5 (MEV),
SIG-PYGMY/SIG-GDR = 0.0245.

MT=51-71
STORED UNDER OPTION-2 (TRANSITION PROBABILITY ARRAY). DATA WERE TAKEN FROM /8/.

MF=14 PHOTON ANGULAR DISTRIBUTIONS
MT=16,17,51-71,91,102,103,107
ISOTROPIC.

MF=15 CONTINUOUS PHOTON ENERGY SPECTRA
MT=16,17,91,102,103,107
CALCULATED WITH GNASH /7/.

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11) BERMAN B.L.: AT. DATA NUCL. DATA TABLES, 15, 319 (1975).
12) IGASHIRA M. ET AL.: INT. SYMP. CAPTURE GAMMA-RAY SPECROSCOPY AND RELATED TOPICS - 1984, 523 (1985).

MAT number = 7240

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 72-HF-179 NAIG+      EVAL-JUL89 HIDA, YOSHIDA AND SHIBATA(JAERI)
                      DIST-SEP89 REV2-JAN94
HISTORY
89-07 NEW EVALUATION FOR JENDL-3 WAS MADE BY K.HIDA, T.YOSHIDA
      (NAIG) AND K.SHIBATA (JAERI).
94-01 JENDL-3.2.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (3,2), (3,4), (3,51-58), (3,61-62)
                 CURVES OF INELASTIC SCATTERING CROSS SECTIONS
                 WERE SMOOTHED BY ADDING INTERPOLATED VALUES AT
                 SEVERAL ENERGY POINTS.
     ***********************************************************


MF=1  GENERAL INFORMATION
 MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
 MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCES FOR MLBW FORMULA
   ENERGY RANGE            : 1.0E-5 EV TO 250 EV
   RES. ENERGIES AND GAM-N : BNL-325 /1/.  IF UNKNOWN, GAM-N IS
                             CALCULATED FROM D-OBS AND S0 GIVEN
                             IN /1/.
   GAM-GAMMA               : 0.066 EV ASSUMED IF UNKNOWN.
   RADIUS                  : 7.8 FM
  UNRESOLVED RESONANCES
   ENERGY RANGE            : 250 EV TO 50 KEV.
   S0, S1, R AND GAM-GAMMA : ADJUSTED SO THAT THE CALCULATED TOTAL
                             AND CAPTURE CROSS SECTIONS WERE
                             REPRODUCED WELL.
   RESULTS ARE D-OBS = 5.71 EV, S0 = 2.20E-4, S1 = 0.83E-4,
   R = 7.7 FM AND GAM-GAMMA = 0.066 EV.

      2200 M/SEC CROSS SECTIONS AND CALCULATED RES. INTEGRALS.
                    2200 M/SEC    RES. INTEG.
          TOTAL      49.5 B          -
          ELASTIC     6.8 B          -
          CAPTURE    42.8 B        523.0 B

MF=3  NEUTRON CROSS SECTIONS
BELOW 50 KEV :
 NO BACKGROUND WAS GIVEN.
ABOVE 50 KEV :
 MT=1,2,4,51-62,91,102  TOTAL,ELASTIC,INELASTIC AND CAPTURE
  CALCULATED WITH ECIS /2/ AND CASTHY /3/.  DEFORMED OPTICAL
  POTENTIAL FOR ECIS CALCULATION WAS DETERMINED SO AS TO
  REPRODUCE THE EXPERIMENTAL TOTAL CROSS SECTION OF NATURAL
  HAFNIUM, STARTING WITH THE HAOUAT POTENTIAL /4/.
     V0 = 46.66-0.3*EN, WS = 3.73+0.4*EN  (EN<10), VSO = 6.2 (MEV),
                             7.73         (EN>10)
     A0 = 0.63,         AS = 0.52,                  ASO = 0.47 (FM),
     R0 = 1.24,         RS = 1.24,                  RSO = 1.12 (FM),
     BETA-2 = 0.261,    BETA-4 = 0.0.
  THE DEFORMATION PARAMETER BETA-2 WAS DETERMINED FROM THE
  MEASURED E2 TRANSITION PROBABILITY DATA /5/.  THE LOWEST THREE
  LEVELS BELONGING TO THE GROUND STATE ROTATIONAL BAND WERE
  COUPLED IN THE CALCULATION.  THE SPHERICAL OPTICAL POTENTIAL
  FOR CASTHY CALCULATION IS THE SAME AS THAT OF JENDL-2.
     V0 = 38.0, WS = 8.0+0.5*SQRT(EN), VSO = 7.0 (MEV),
     A0 = 0.47, AS = 0.52            , ASO = 0.47 (FM),
     R0 = 1.32, RS = 1.32            , RSO = 1.32 (FM).
  CAPTURE CROSS SECTION WAS NORMALIZED TO THE MEASURED DATA OF
  BEER ET AL. /6/ AT 30 KEV.  COMPETING PROCESSES (N,2N), (N,3N),
  (N,P), AND (N,ALPHA) WERE CALCULATED WITH GNASH /7/ AND FED TO
  ECIS-CASTHY CALCULATION.  THE LEVEL FLUCTUATION AND INTERFERENCE
  EFFECTS WERE CONSIDERED.  LEVEL SCHEME WAS TAKEN FROM TABLE OF
  ISOTOPES /8/.
         NO.     ENERGY(MEV)   SPIN-PARITY
         G.S.     0.0            9/2 +
          1       0.1227        11/2 +
          2       0.2143         7/2 -
          3       0.2688        13/2 +
          4       0.3377         9/2 -
          5       0.3750         1/2 -
          6       0.4386        15/2 +
          7       0.5184         5/2 -
          8       0.6169         7/2 -
          9       0.6312        17/2 +
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        10       0.8483          19/2 +
        11       0.8702           7/2 -
        12       1.0034           5/2 +
   CONTINUUM LEVELS ASSUMED ABOVE 1.0700 MEV.
  THE LEVEL DENSITY PARAMETERS FOR GILBERT AND CAMERON'S FORMULA
  /9/ ARE THE SAME AS THOSE OF JENDL-2.
                A(1/MEV)   C(1/MEV)  T(MEV)   EX(MEV)  SIGMA**2
        HF-179    22.57      6.88     0.465     3.98     9.31
        HF-180    21.37      2.35     0.519     5.42     7.64

 MT=16,17,103,107  (N,2N), (N,3N), (N,P) AND (N,ALPHA)
  CALCULATED WITH GNASH /7/. THE TRANSMISSION COEFFICIENTS FOR
  THE THE INCIDENT CHANNEL WERE GENERATED WITH ECIS /2/, WHILE
  THOSE FOR THE EXIT CHANNELS WITH ELIESE-3 /10/.  THE PREEQUILI-
  BRIUM PARAMETER F2 WAS F2=5.0.

 MT=251  MU-BAR
  CALCULATED WITH ECIS /2/ AND CASTHY /3/.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=2,51-62,91
  CALCULATED WITH ECIS /2/ AND CASTHY /3/.
 MT=16,17
  ISOTROPIC IN THE LABORATORY SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=16,17,91
  CALCULATED WITH GNASH /7/.

MF=12 PHOTON MULTIPLICITIES AND TRANSITION PROBABILITIES
 MT=16,17,91,102,103,107
  CALCULATED WITH GNASH /7/ AND STORED UNDER OPTION-1 (PHOTON
  PRODUCTION MULTIPLICITIES).  THE PHOTON STRENGTH FUNCTIONS FOR
  MOST NUCLEI WERE TAKEN FROM /1/, WHILE THOSE FOR SOME HAFNIUM
  ISOTOPES WERE DETERMINED FROM CAPTURE CROSS SECTION NORMALIZA-
  TION TO THE EXPERIMENTAL DATA.  THE PHOTON PROFILE FUNCTION IS A
  SUPERPOSITION OF THE BERMAN-TYPE GIANT DIPOLE RESONANCE /11/
  AND THE PYGMY RESONANCE WHOSE PARAMETER VALUES WERE CITED FROM
  THE NEIGHBOURING NUCLEUS TA /12/.
        EG1 = 15.23,   EG2 = 12.3 ,   EP = 5.2 (MEV),
        GG1 =  4.48,   GG2 =  2.43,   GP = 2.5 (MEV),
        SIG-PYGMY/SIG-GDR = 0.0245.

 MT=51-62
  STORED UNDER OPTION-2 (TRANSITION PROBABILITY ARRAY).  DATA WERE
  TAKEN FROM /8/.

MF=14 PHOTON ANGULAR DISTRIBUTIONS
 MT=16,17,51-62,91,102,103,107
  ISOTROPIC.

MF=15 CONTINUOUS PHOTON ENERGY SPECTRA
 MT=16,17,91,102,103,107
  CALCULATED WITH GNASH /7/.
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    AND RELATED TOPICS - 1984, 523 (1985).
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MAT number = 7243
 72-HF-180 NAIG+      EVAL-JUL89 HIDA, YOSHIDA AND SHIBATA(JAERI)
                      DIST-SEP89 REV2-JAN94
HISTORY
89-07 NEW EVALUATION FOR JENDL-3 WAS MADE BY K.HIDA, T.YOSHIDA
      (NAIG) AND K.SHIBATA (JAERI).
94-01 JENDL-3.2.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (3,2), (3,4), (3,51-52), (3,56-61)
                 CURVES OF INELASTIC SCATTERING CROSS SECTIONS
                 WERE SMOOTHED BY ADDING INTERPOLATED VALUES AT
                 SEVERAL ENERGY POINTS.
     ***********************************************************


MF=1  GENERAL INFORMATION
 MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
 MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED RESONANCES FOR MLBW FORMULA
   ENERGY RANGE             : 1.0E-5 EV TO 2.5 KEV
   RES. ENERGIES AND GAM-N : BNL-325 /1/.  IF UNKNOWN, GAM-N IS
                              CALCULATED FROM D-OBS AND S0, AND IN
                              THIS CASE, GAM-GAMMA FROM
                              (GAM-N)*(GAM-GAMMA)/(GAM-TOTAL).
   GAM-GAMMA                : 0.050 EV ASSUMED IF UNKNOWN.
   RADIUS                   : 8.0 FM
  UNRESOLVED RESONANCES
   ENERGY RANGE             : 2.5 KEV TO 50 KEV.
   S0, S1,R AND GAM-GAMMA  : ADJUSTED SO THAT THE CALCULATED TOTAL
                              AND CAPTURE CROSS SECTIONS WERE
                              REPRODUCED WELL.
   RESULTS ARE D-OBS = 158 EV, S0 = 1.90E-4, S1 = 0.44E-4,
   R = 8.5 FM AND GAM-GAMMA = 0.05 EV.

      2200 M/SEC CROSS SECTIONS AND CALCULATED RES. INTEGRALS.
                    2200 M/SEC    RES. INTEG.
          TOTAL       34.2 B          -
          ELASTIC     21.2 B          -
          CAPTURE     13.0 B        34.1 B

MF=3  NEUTRON CROSS SECTIONS
BELOW 50 KEV :
 NO BACKGROUND WAS GIVEN.
ABOVE 50 KEV :
 MT=1,2,4,51-61,91,102  TOTAL,ELASTIC,INELASTIC AND CAPTURE
  CALCULATED WITH ECIS /2/ AND CASTHY /3/.  DEFORMED OPTICAL
  POTENTIAL FOR ECIS CALCULATION WAS DETERMINED SO AS TO
  REPRODUCE THE EXPERIMENTAL TOTAL CROSS SECTION OF NATURAL
  HAFNIUM, STARTING WITH THE HAOUAT POTENTIAL /4/.
     V0 = 46.60-0.3*EN, WS = 3.70+0.4*EN (EN<10), VSO = 6.2 (MEV),
                             7.70        (EN>10)
     A0 = 0.63,         AS = 0.52,                  ASO = 0.47 (FM),
     R0 = 1.24,         RS = 1.24,                  RSO = 1.12 (FM),
     BETA-2 = 0.256,    BETA-4 = 0.0.
  THE DEFORMATION PARAMETER BETA-2 WAS DETERMINED FROM THE
  MEASURED E2 TRANSITION PROBABILITY DATA /5/.  THE LOWEST THREE
  LEVELS BELONGING TO THE GROUND STATE ROTATIONAL BAND WERE
  COUPLED IN THE CALCULATION.  THE SPHERICAL OPTICAL POTENTIAL
  FOR CASTHY CALCULATION IS THE SAME AS THAT OF JENDL-2.
     V0 = 38.0, WS = 8.0+0.5*SQRT(EN), VSO = 7.0 (MEV),
     A0 = 0.47, AS = 0.52            , ASO = 0.47 (FM),
     R0 = 1.32, RS = 1.32            , RSO = 1.32 (FM).
  CAPTURE CROSS SECTION WAS NORMALIZED TO THE MEASURED DATA OF
  BEER ET AL. /6/ AT 30 KEV.  COMPETING PROCESSES (N,2N), (N,3N),
  (N,P), AND (N,ALPHA) WERE CALCULATED WITH GNASH /7/ AND FED TO
  ECIS-CASTHY CALCULATION.  THE LEVEL FLUCTUATION AND INTERFERENCE
  EFFECTS WERE CONSIDERED.  LEVEL SCHEME WAS TAKEN FROM TABLE OF
  ISOTOPES /8/.
         NO.     ENERGY(MEV)   SPIN-PARITY
         G.S.     0.0             0 +
          1       0.09332         2 +
          2       0.3086          4 +
          3       0.6409          6 +
          4       1.0839          8 +
          5       1.1416          8 -
          6       1.1832          4 +
          7       1.1997          2 +
          8       1.2910          4 +
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        9       1.3744          3 -
       10       1.4092          4 +
       11       1.5393          3 -
   CONTINUUM LEVELS ASSUMED ABOVE 1.6076 MEV.
  THE LEVEL DENSITY PARAMETERS FOR GILBERT AND CAMERON'S FORMULA
  /9/ ARE THE SAME AS THOSE OF JENDL-2.
                A(1/MEV)   C(1/MEV)  T(MEV)   EX(MEV)  SIGMA**2
       HF-180    21.37      2.35     0.519     5.42     7.64
       HF-181    21.91      6.47     0.479     4.08     4.88

 MT=16,17,103,107  (N,2N), (N,3N), (N,P) AND (N,ALPHA)
  CALCULATED WITH GNASH /7/. THE TRANSMISSION COEFFICIENTS FOR
  THE INCIDENT CHANNEL WERE GENERATED WITH ECIS /2/, WHILE THOSE
  FOR THE EXIT CHANNELS WITH ELIESE-3 /10/.  THE PREEQUILIBRIUM
  PARAMETER F2 WAS F2=5.0.

 MT=251  MU-BAR
  CALCULATED WITH ECIS /2/ AND CASTHY /3/.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=2,51-61,91
  CALCULATED WITH ECIS /2/ AND CASTHY /3/.
 MT=16,17
  ISOTROPIC IN THE LABORATORY SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=16,17,91
  CALCULATED WITH GNASH /7/.

MF=12 PHOTON MULTIPLICITIES AND TRANSITION PROBABILITIES
 MT=16,17,91,102,103,107
  CALCULATED WITH GNASH /7/ AND STORED UNDER OPTION-1 (PHOTON
  PRODUCTION MULTIPLICITIES).  THE PHOTON STRENGTH FUNCTIONS FOR
  MOST NUCLEI WERE TAKEN FROM /1/, WHILE THOSE FOR SOME HAFNIUM
  ISOTOPES WERE DETERMINED FROM CAPTURE CROSS SECTION NORMALIZA-
  TION TO THE EXPERIMENTAL DATA.  THE PHOTON PROFILE FUNCTION IS
  A SUPERPOSITION OF THE BERMAN-TYPE GIANT DIPOLE RESONANCE /11/
  AND THE PYGMY RESONANCE WHOSE PARAMETER VALUES WERE CITED FROM
  THE NEIGHBOURING NUCLEUS TA /12/.
       EG1 = 15.23,   EG2 = 12.3 ,   EP = 5.2 (MEV),
       GG1 =  4.48,   GG2 =  2.43,   GP = 2.5 (MEV),
       SIG-PYGMY/SIG-GDR = 0.0245.

 MT=51-61
  STORED UNDER OPTION-2 (TRANSITION PROBABILITY ARRAY).  DATA WERE
  TAKEN FROM /8/.

MF=14 PHOTON ANGULAR DISTRIBUTIONS
 MT=16,17,51-61,91,102,103,107
  ISOTROPIC.

MF=15 CONTINUOUS PHOTON ENERGY SPECTRA
 MT=16,17,91,102,103,107
  CALCULATED WITH GNASH /7/.
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    AND RELATED TOPICS - 1984, 523 (1985).
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MAT number = 7328
 73-TA-181 NAIG       EVAL-MAR87 N.YAMAMURO
                      DIST-SEP89 REV2-FEB94
HISTORY
76-03 THE EVALUATION FOR JENDL-1 /1/ WAS MADE BY H.YAMAKOSHI
      (SHIP RESEARCH INSTITUTE) AND JENDL-1 COMPILATION GROUP.
83-03 JENDL-1 DATA WERE ADOPTED FOR JENDL-2 AND EXTENDED TO 20
      MEV. MF=5 WAS REVISED, AND UNRESOLVED RESONANCE PARAMETERS
      WERE ADDED BY Y.KIKUCHI (JAERI) /2/.
83-11 COMMENT DATA WERE ADDED.
87-03 THE EVALUATION FOR JENDL-3 WAS MADE BY N.YAMAMURO (NAIG).
      RESONANCE PARAMETERS WERE ADDED BY NEW EXPERIMENTAL DATA.
      NEUTRON CROSS SECTIONS, EXCEPT TOTAL AND ELASTIC SCATTERING
      CROSS SECTIONS, AND ENERGY DISTRIBUTIONS OF SECONDARY
      NEUTRONS AND PHOTONS WERE CALCULATED WITH GNASH /3/ AND
      CASTHY /4/ CODES.
94-02 JENDL-3.2.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (12,102)
             DATA WERE DETERMINED FROM ENERGY BALANCE.
     ***********************************************************


MF=1   GENERAL INFORMATION
  MT=451     DESCRIPTIVE DATA AND DICTIONARY

MF=2   RESONANCE PARAMETERS
  MT=151     RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  RESOLVED PARAMETERS FOR MLBW FORMULA

      THE ENERGY REGION FROM 1.0E-5EV TO 1.0 KEV. PARAMETERS WERE
      TAKEN FROM REFS./5,6,7/ FOR POSITIVE RESONANCES, AND FROM
      ENDF/B-IV FOR A NEGATIVE RESONANCE. THE RADIATIVE WIDTH OF
      0.059EV WAS ASSUMED FOR THE RESONANCE WHOSE RADIATIVE WIDTH
      WAS UNKNOWN.

  UNRESOLVED PARAMETERS

      IN THE ENERGY RANGE FROM 1 TO 100KEV, PARAMETERS WERE
      DETERMINED TO REPRODUCE THE MEASURED CAPTURE CROSS SECTIONS
      /6,8/. THE PARAMETERS ARE AS FOLLOWS,

         R= 7.8 FM , DOBS= 4.2 EV , RADIATIVE WIDTH= 0.065 EV,
         S0= 1.7E-04  S1= 2.0E-05  S2= 2.3E-04  NL= 3

      CALCULATED 2200-M/SEC CROSS SECTIONS AND RESONANCE INTEGRALS
                        2200-M/SEC       RES. INTEG
          ELASTIC          5.65 B            -
          CAPTURE         20.67 B          660.43 B
          TOTAL           26.32 B            -

MF=3   NEUTRON CROSS SECTIONS
  MT=1   TOTAL
    EVALUATED FROM EXPERIMENTAL DATA.
  MT=2   ELASTIC SCATTERING
    (TOTAL CROSS SECTION) - (REACTION CROSS SECTION)
  MT=4,51-64,91 INELASTIC SCATTERING
     BELOW 3 MEV,CALCULATED WITH OPTICAL AND STATISTICAL MODEL
     CODE CASTHY/4/, AND ABOVE 3 MEV CALCULATED WITH STATISTICAL
     AND PREEQUILIBRIUM MODEL CODE GNASH/3/.  WILMORE-HODGSON'S
     OPTICAL-MODEL POTENTIAL PARAMETERS/9/ WERE USED, WHICH
     REPRODUCED THE EXPERIMENTAL NONELASTIC CROSS SECTIONS UP TO
     15 MEV.

          V=47.01-0.267E-0.00118E   (MEV)
          WS=9.52-0.053E            (MEV)
          R0=1.268,   AS=0.66       (FM)
          RS=1.241,   AS=0.48       (FM)

     THE LEVEL SCHEME WAS ADOPTED FROM REF./10/.

               NO.        ENERGY (MEV)      SPIN-PARITY
               G.S.         0.0                7/2+
                1           0.0062             9/2-
                2           0.136              9/2+
                3           0.159             11/2-
                4           0.301             11/2+
                5           0.338             13/2-
                6           0.482              5/2+
                7           0.495             13/2+
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8	0.543	15/2-
9	0.615	1/2+
10	0.619	3/2+
11	0.717	15/2+
12	0.773	17/2-
13	0.965	17/2+
14	1.028	19/2-

LEVELS ABOVE 1.03MEV WERE ASSUMED TO OVERLAPPING.
LEVEL DENSITY PARAMETERS USED WERE AS FOLLOWS,

	1/MEV	PAIR-E	T(MEV)	E (MEV)	SPIN-CUTOFF
TA-178	22.5	0.0	0.54	4.2	13.0
TA-179	22.0	0.4	0.53	4.2	18.0
TA-180	22.5	0.0	0.54	4.2	13.0
TA-181	22.0	0.73	0.52	4.3	29.0
TA-182	21.8	0.0	0.56	4.3	13.0

MT=16 (N,2N) CROSS SECTION
CALCULATED WITH GNASH/3/.
MT=17 (N,3N) CROSS SECTION
CALCULATED WITH GNASH/3/.
MT=28 (N,N P) CROSS SECTION
CALCULATED WITH GNASH /3/.
MT=102 RADIATIVE CAPTURE CROSS SECTION
CALCULATED WITH CASTHY/4/.
MT=103 (N,P) CROSS SECTION
CALCULATED WITH GNASH/3/.
MT=203 TOTAL HYDROGEN PRODUCTION
CALCULATED WITH GNASH/3/.
MT=251 MU-BAR
CALCULATED WITH CASTHY/4/.

MF=4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=2 CALCULATED WITH CASTHY/4/.
MT=51-64,91,16,17,28
ISOTROPIC IN THE CENTER-OF-MASS SYSTEM WAS ASSUMED.

MF=5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=16,17,28,91
CALCULATED WITH GNASH/3/.

MF=12 PHOTON PRODUCTION MULTIPLICITIES (OPTION1)
MT=51-64.91,16,17,28,103
CALCULATED WITH GNASH/3/.
MT=102
FROM ENERGY BALANCE.

MF=14 PHOTON ANGULAR DISTRIBUTIONS
ISOTROPIC IN THE CENTER-OF-MASS SYSTEM WAS ASSUMED.

MF=15 CONTINUOUS PHOTON ENERGY SPECTRA
MT=91,16,17,28,102,103
CALCULATED WITH GNASH/3/.

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MAT number = 7400

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 74-W -  0 KHI,NEDAC  EVAL-MAR87 T.WATANABE(KHI), T.ASAMI(NEDAC)
                      DIST-SEP89 REV2-JUN94
HISTORY
87-03 NEW EVALUATION WAS MADE FOR JENDL-3.
87-03 COMPILED BY T.ASAMI.
89-08 MF/MT=15/102 MODIFIED.
94-06 JENDL-3.2.
        GAMMA PRODUCTION DATA MODIFIED BY T.ASAMI(DATA ENG.).
        OTHERS WERE MAINLY BASED ON JENDL FUSION FILE.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      ALL CROSS SECTIONS EXCEPT TOTAL
             THE INELASTIC SCATTERING, (N,2N), (N,3N), (N,NP),
             (N,NA), (N,P), (N,D) AND (N,A) CROSS SECTIONS WERE
             TAKEN FROM JENDL FUSION FILE.  FURTHER MODIFICATION
             WAS MADE FOR THE INELASTIC SCATTERING AND CAPTURE
             CROSS SECTIONS.
      (4,16-28), (4,91), (5,16-91)
                     TAKEN FROM JENDL FUSION FILE.
      (12,102)       UP TO 400 KEV
      (13,4)         UP TO 400 KEV
      (13,3), (15,3) ENERGY RANGE WAS CHANGED
      (15,102)
     ***********************************************************

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      JENDL FUSION FILE /1/  (AS OF JAN. 1994)
            EVALUATED BY K.KOSAKO (NEDAC) AND S.CHIBA (NDC/JAERI)
            COMPILED  BY K.KOSAKO.

       -  THE INELASTIC SCATTERING CROSS SECTIONS TO HIGH EXCITED
          LEVELS WERE CALCULATED WITH CASTHY2Y AND DWUCKY IN
          SINCROS-II SYSTEM/2/ INCLUDING CONTRIBUTIONS FROM DIRECT
          REACTIONS.
       -  THE (N,2N), (N,3N), (N,NA), (N,NP), (N,P), (N,D) AND
          (N,A) REACTION CROSS SECTIONS (MT=16, 17, 22, 28, 103,
          104, 107) WERE CALCULATED BY EGNASH2 IN THE SINCROS-II.
       -  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE REPLACED
          BY THOSE CALCULATED BY EGNASH2.  THE DDX'S OF THE
          CONTINUUM NEUTRONS WERE CALCULATED BY KUMABE'S SYSTEMA-
          TICS /3/ USING F15TOB /1/.  THE PRECOMPOUND/COMPOUND
          RATIO WAS CALCULATED BY THE SINCROS-II CODE SYSTEM.
       -  THE RESONANCE PARAMETERS, TOTAL AND CAPTURE CROSS
          SECTIONS WERE TAKEN FROM JENDL3.1.
       -  OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED IN
          THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./2/.
          LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/4/.
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   ALL THE DATA WERE CONSTRUCTED WITH THE EVALUATED ONES OF W-182,
   -183, -184 AND -186, TAKING ACCOUNT OF THEIR ABUNDANCES IN THE
   W ELEMENT. THE ABUNDANCE DATA WERE TAKEN FROM REF./5/ TO BE
   0.263, 0.143, 0.3067 AND 0.286 FOR W-182, -183, -184 AND -186,
   RESPECTIVELY. ALL THE DATA OF W-180 WERE IGNORED BECAUSE OF ITS
   VERY LOW ABUNDANCE.  THE ABUNDANCE OF 0.2643 WAS USED FOR W-182
   SOMETIMES.

MF=1  GENERAL INFORMATION
 MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
 MT=151  RESOLVED RESONANCE PARAMETERS
    RESOLVED PARAMETERS FOR MLBW FORMULA WERE TAKEN FROM THE
    EVALUATED DATA ON EACH STABLE ISOTOPE.  THE ENERGY REGION WAS
    TAKEN FROM 1.0E-5 EV TO 15 KEV.  CALCULATED 2200 M/SEC CROSS
    SECTIONS AND RESONANCE INTEGRALS ARE AS FOLLOWS:

            2200 M/S CROSS SECTION(B)     RES. INTEGRAL(B)
    TOTAL        23.224
    ELASTIC       4.973
    CAPTURE      18.251                      317.5

MF=3  NEUTRON CROSS SECTIONS
   BELOW 15 KEV, BACKGROUND CROSS SECTION WAS GIVEN.

   FOR JENDL-3.1, ABOVE THE RESONANCE REGION, THE TOTAL AND
   PARTIAL CROSS SECTIONS OF EACH ISOTOPE WERE MAINLY BASED ON
   THEORETICAL CALCULATIONS.  THE TOTAL, ELASTIC AND INELASTIC
   SCATTERING, AND CAPTURE CROSS SECTIONS WERE CALCULATED WITH THE
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COUPLED-CHANNEL MODEL AND THE SPHERICAL OPTICAL-STATISTICAL MODEL. THE CALCULATIONS WERE PERFORMED WITH A COMBINED PROGRAM OF CASTHY/6/ AND ECIS/7/. THE OPTICAL POTENTIAL PARAMETERS USED ARE:

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     V = 48.83 - 0.0809*EN,    VSO = 5.6     (MEV)
    WS = 6.73 - 0.0536*EN,      WV = 0       (MEV)
     R = 1.168,  RS = 1.268,   RSO = 1.592   (FM)
     A = 0.617, ASO = 0.664,     B = 0.563   (FM)
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THE DEFORMED POTENTIAL PARAMETERS WERE TAKEN FROM THE WORK OF DELAROCHE/8/.

FOR JENDL-3.2, ALL CROSS SECTION DATA EXCEPT FOR THE TOTAL, ELASTC SCATTERING AND CAPTURE WERE ADOPTED FROM JENDL FUSION FILE. NEW THEORETICAL CALCULATION WAS MADE WITH SINCROS-II SYSTEM/2/ BY ADOPTING WALTER-GUSS OMP MODIFIED BY YAMAMURO/2/ FOR NEUTRON, PEREY OMP /9/ FOR PROTON, LEMOS OMP MODIFIED BY ARTHUR AND YOUNG/10/ FOR ALPHA, LOHR-HAEBERLI OMP/11/ FOR DEUTERON, BECCHETTII-GREENLEES OMP/12/ FOR TRITON AND HE-3, AND STANDARD LEVEL DENSITY PARAMETERS OF SINCROS-II SYSTEM.

MT=1 TOTAL
[SAME AS JENDL-3.1]
THE DATA WERE CONSTRUCTED FROM THOSE OF FOUR W ISOTOPES WHICH WERE CALCULATED WITH THE OPTICAL MODEL.

MT=2 ELASTIC SCATTERING
OBTAINED BY SUBTRACTING THE SUM OF THE PARTIAL CROSS SECTIONS FROM THE TOTAL CROSS SECTION.

MT=4, 51-90, 91 INELASTIC SCATTERING
THE DATA FOR ISOTOPES WERE CALCULATED WITH THE COMBINED PROGRAM OF THE ECIS/7/ AND CASTHY /6/, AND SINCROS-II. THE DATA FOR NATURAL W WERE CONSTRUCTED FROM THE CALCULATED VALUES FOR EACH W ISOTOPE AS FOLLOWS:

MT	LEVEL ENERGY(MEV)	W-182	W-183	W-184	W-186
G.S.	0.0				
51	0.0465		51		
52	0.0991		52		
53	0.1001	51			
54	0.1112			51	
55	0.1226				51
56	0.2070		53		
57	0.2088		54		
58	0.2917		55		
59	0.3089		56		
60	0.3095		57		
61	0.3294	52			
62	0.3641			52	
63	0.3968				52
64	0.4121		58		
65	0.4870		59		
66	0.5500		60		
67	0.6805	53			
68	0.7377				53
69	0.7483			53	
70	0.8088				54
71	0.8618				55
72	0.8820				56
73	0.9033			54	
74	0.9526				57
75	1.0023			55	
76	1.0059			56	
77	1.0070				58
78	1.0316				59
79	1.0452				60
80	1.1214			57	
81	1.1357	54			
82	1.1445	55			
83	1.1500				61
84	1.2213			58	
85	1.2214	56			
86	1.2840				62
87	1.2950			59	
88	1.3221	60			
89	1.3311	57			
90	1.4428	58			

THE OTHER INELASTIC SCATTERING CROSS SECTIONS WERE SUMMED UP TO MT=91

MT=16, 17, 22, 28, 102, 103 AND 107
(N,2N), (N,3N), (N,NA), (N,NP), CAPTURE, (N,P) AND (N,A)

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   CONSTRUCTED FROM THE EVALUATED DATA FOR FOUR STABLE ISOTOPES OF
   W.  THE CALCULATED CAPTURE CROSS SECTION FOR EACH W ISOTOPE WAS
   NORMALIZED SO AS TO REPRODUCE THE ELEMENT W DATA OF 60+-6 MB AT
   500 KEV/13/.

 MT=251      MU-BAR
   CALCULATED FROM MF/MT=4/2.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
        (MF=2, 51-90:  THE SAME AS JENDL-3.1)
 MT=2
   CONSTRUCTED FROM THE EVALUATED DATA FOR FOUR STABLE ISOTOPES
   OF W.
 MT=51-90
   CONSTRUCTED FROM THE EVALUATED DATA FOR FOUR STABLE ISOTOPES.
 MT=16, 17, 22, 28, 91
   TAKEN FROM JENDL FUSION FILE.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=16, 17, 22, 28, 91
   TAKEN FROM JENDL FUSION FILE.

MF=12 PHOTON PRODUCTION MULTIPLICITIES
 MT=102 (BELOW 400 KEV)
    CALCULATED FROM ENERGY BALANCE.

MF=13 PHOTON PRODUCTION CROSS SECTIONS
 MT=3 (ABOVE 400 KEV)
    CALCULATED WITH THE GNASH CODE/14/.
 MT=4 (UP TO 400 KEV)
    CALCULATED FROM CROSS SECTIONS AND TRANSITION PROBABILITIES
    FOR LEVELS UP TO 400 KEV.

MF=14 PHOTON ANGULAR DISTRIBUTIONS
 MT=3, 4, 102
    ASSUMED TO BE ISOTROPIC IN THE LABORATORY SYSTEM.

MF=15 CONTINUOUS PHOTON ENERGY SPECTRA
 MT=3
    CALCULATED WITH THE GNASH CODE/14/.
 MT=102
    CALCULATED WITH THE GNASH CODE/14/ IN THE ENERGY RANGE ABOVE
    10 KEV, AND WITH CASTHY/6/ BELOW 1 KEV.

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MAT number = 7431
 74-W -182 KHI,NEDAC  EVAL-MAR87 T.WATANABE(KHI), T.ASAMI(NEDAC)
                      DIST-SEP89 REV2-JAN94
HISTORY
87-03 NEW EVALUATION WAS MADE FOR JENDL-3.
87-03 COMPILED BY T.ASAMI.
94-01 JENDL-3.2.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      ALL CROSS SECTIONS EXCEPT TOTAL
             THE INELASTIC SCATTERING, (N,2N), (N,3N), (N,NP),
             (N,NA), (N,P), (N,D) AND (N,A) CROSS SECTIONS WERE
             TAKEN FROM JENDL FUSION FILE.  FURTHER MODIFICATION
             WAS MADE FOR THE INELASTIC SCATTERING AND CAPTURE
             CROSS SECTIONS.
      (4,16-91), (5,16-91)
             THESE DATA WERE TAKEN FROM JENDL FUSION FILE.
     ***********************************************************

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      JENDL FUSION FILE /1/  (AS OF JAN. 1994)
            EVALUATED BY K.KOSAKO (NEDAC) AND S. CHIBA (NDC/JAERI)
            COMPILED  BY K.KOSAKO.

      DATA WERE TAKEN FROM JENDL-3.1 EXCEPT FOR THE FOLLOWING:
      -  THE INELASTIC SCATTERING CROSS SECTIONS TO THE LEVELS
         ABOVE MT=59 AND ANGULAR DISTRIBUTIONS OF INELASTICALLY
         SCATTERED NEUTRONS (EXCEPT CONTINUUM INELASTIC) WERE
         CALCULATED WITH CASTHY2Y AND DWUCKY IN SINCROS-II
         SYSTEM/2/ INCLUDING CONTRIBUTIONS FROM DIRECT REACTIONS.
      -  THE (N,2N), (N,3N), (N,NA), (N,NP), (N,P), (N,D) AND
         (N,A) REACTION CROSS SECTIONS (MT=16, 17, 22, 28, 103,
         104, 107) WERE CALCULATED BY EGNASH2 IN THE SINCROS-II.
      -  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE REPLACED
         BY THOSE CALCULATED BY EGNASH2.  THE DDX'S OF THE
         CONTINUUM NEUTRONS WERE CALCULATED BY KUMABE'S SYSTEMA-
         TICS /3/ USING F15TOB /1/.  THE PRECOMPOUND/COMPOUND
         RATIO WAS CALCULATED BY THE SINCROS- II CODE SYSTEM.
      -  OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED IN
         THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./2/.
         LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/4/.
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MF=1  GENERAL INFORMATION
 MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
 MT=151  RESOLVED RESONANCE PARAMETERS
   RESOLVED PARAMETERS FOR MLBW FORMULA WERE GIVEN IN THE ENERGY
   REGION FROM 1.0E-5 EV TO 12 KEV.
      PARAMETERS WERE EVALUATED IN EXAMINING BOTH THE EXPERIMENTAL
   DATA/5,6,7/ AND THE RECOMMENDED DATA IN REF./8/.  FOR UNKNOWN
   RADIATIVE WIDTH, AN AVERAGE VALUE OF 53 MILLI-EV WAS ASSUMED.
   PARAMETERS FOR A NEGATIVE RESONANCE WERE SELECTED SO THAT THE
   2200 M/S CROSS SECTIONS AGREED WITH A RECOMMENDED CAPTURE CROSS
   SECTION OF 20.7 BARNS/8/ AND THE EXPERIMENTAL DATA FOR TOTAL
   CROSS SECTIONS AROUND THERMAL ENERGIES.  THE SCATTERING RADIUS
   WAS ASSUMED TO BE 7.5 FERMI.

   CALCULATED 2200 M/SEC CROSS SECTIONS AND RESONANCE INTEGRALS
   ARE AS FOLLOWS:
           2200 M/S CROSS SECTION(B)     RES. INTEGRAL(B)
   ELASTIC        8.84
   CAPTURE       20.7                         629.
   TOTAL         29.5

MF=3  NEUTRON CROSS SECTIONS
   BELOW 12 KEV, ZERO BACKGROUND CROSS SECTION WAS GIVEN AND  ALL
   THE CROSS-SECTION DATA ARE REPRODUCED FROM THE EVALUATED
   RESOLVED RESONANCE PARAMETERS.

   FOR JENDL-3.1, ABOVE 12 KEV, THE TOTAL AND PARTIAL CROSS
   SECTIONS WERE GIVEN MAINLY BASED ON THE THEORETICAL CALCULA-
   TIONS. THE TOTAL, ELASTIC AND INELASTIC SCATTERING, AND CAPTURE
   CROSS SECTIONS WERE CALCULATED WITH THE COUPLED-CHANNEL MODEL
   AND THE SPHERICAL OPTICAL-STATISTICAL MODEL.  THE CALCULATIONS
   WERE PERFORMED WITH A COMBINED PROGRAM OF CASTHY/9/ AND
   ECIS/10/.  THE OPTICAL POTENTIAL PARAMETERS USED ARE:
         V = 48.83 - 0.0809*EN,     VSO = 5.6    (MEV)
        WS = 6.73 - 0.0536*EN,       WV = 0      (MEV)
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      R = 1.168, RS = 1.268, RSO = 1.592      (FM)
      A = 0.617, ASO = 0.664, B = 0.563       (FM)
  THE DEFORMED POTENTIAL PARAMETERS WERE TAKEN FROM THE WORK OF
  DELAROCHE/11/.

  FOR JENDL-3.2, ALL CROSS SECTION DATA EXCEPT FOR THE TOTAL,
  ELASTIC SCATTERING AND CAPTURE WERE ADOPTED FROM JENDL FUSION
  FILE.  THE CALCULATION WAS MADE WITH SINCROS-II SYSTEM/2/ BY
  ADOPTING WALTER-GUSS OMP MODIFIED BY YAMAMURO/2/ FOR NEUTRON,
  PEREY OMP /12/ FOR PROTON, LEMOS OMP MODIFIED BY ARTHUR AND
  YOUNG/13/ FOR ALPHA, LOHR-HAEBERLI OMP/14/ FOR DEUTERON,
  BECCHETTII-GREENLEES OMP/15/ FOR TRITON AND HE-3, AND STANDARD
  LEVEL DENSITY PARAMETERS OF SINCROS-II SYSTEM.

MT=1 TOTAL
  CALCULATED WITH THE COMBINED PROGRAM OF THE ECIS AND CASTHY
  CODES. ALMOST THE SAME AS JENDL-3.1.

MT=2 ELASTIC SCATTERING
  OBTAINED BY SUBTRACTING THE SUM OF THE PARTIAL CROSS SECTIONS
  FROM THE TOTAL CROSS SECTION.

MT=4, 51-70, 91 INELASTIC SCATTERING
  THE DATA OF MT=51 TO 58 WERE CALCULATED WITH THE COMBINED
  PROGRAM OF ECIS/10/ AND CASTHY /9/.  THESE CROSS SECTIONS IN
  JENDL-3.2 ARE THE SAME AS JENDL-3.1 EXCEPT THAT NEW CALCULATION
  WAS MADE AT SEVERAL ENERGY POINTS.  THE OTHER CROSS SECTIONS
  WERE CALCULATED WITH SINCROS-II FOR JENDL FUSION FILE.  THE
  LEVEL SCHEME WAS BASED ON REF./4/ CONTRIBUTIONS OF THE DIRECT
  PROCESS WAS CALCULATED FOR THE LEVELS MARKED WITH '*'.

      NO.  MT    ENERGY(MEV)     SPIN-PARITY (DIRECT PROCESS)
     G.S.          0.0              0+
       1    51     0.1001           2+          *
       2    52     0.3294           4+          *
       3    53     0.6805           6+          *
       4    54     1.1358           0+
       5    55     1.1444           8+          *
       6    56     1.2214           2+
       7    56     1.2574           2+
       8    56     1.2892           2-
       9    57     1.3311           3+
      10    57     1.3738           3-
      11    58     1.4428           4+
      12    58     1.4875           4-
      13    58     1.5102           4+
      14    58     1.5532           4-
      15    58     1.6213           5-
      16    58     1.6235           5+
      17    58     1.6604           5-
      18    59     1.7119          10+          *
      19    60     1.7568           6+
      20    61     1.7654           4+
      21    62     1.7690           5-
      22    63     1.8097           5-
      23    64     1.8109           6-
      24    65     1.8134           4-
      25    66     1.8295           6-
      26    67     1.8331           2-
      27    68     1.8560           2+
      28    69     1.8569           2+
      29    70     1.8712           1-
  LEVELS ABOVE 1.872 MEV WERE ASSUMED TO BE OVERLAPPING.  DATA OF
  LEVELS 6-8, 9-10 AND 11-17 WERE LUMPED AS IS INDICATED IN THE
  ABOVE TABLE.  THE DIRECT INELASTIC SCATTERING CROSS SECTION WAS
  CALCULATED ALSO FOR THE LEVELS AT 1.959, 2.372, 2.493, 3.112,
  3.397, 3.6, 4.0, 4.5, 5.0, 5.5 AND 6.0 MEV AND ADDED TO MT=91.

MT=16, 17, 22, 28, 103, 104, 107
       (N,2N), (N,3N), (N,NA), (N,NP), (N,P), (N,D), (N,A)
  ADOPTED FROM JENDL FUSION FILE.  THEORETICAL CALCULATION WAS
  MADE WITH SINCROS-II.  THE RESULTS WERE NORMALIZED TO
       (N,2N)   2.161 B AT 14.7 MEV MEASURED BY QAIM/16/,
       (N,P)   0.0059 B AT 14.7 MEV MEASURED BY QAIM/16/,
  (N,D)+(N,NP)  0.002 B AT 14.7 MEV (SYSTEMATICS OF QAIM/16/),
       (N,A)    0.002 B AT 14.7 MEV (SYSTEMATICS OF QAIM/16/).

MT=102      CAPTURE
  CALCULATED WITH THE CASTHY CODE/9/ AND NORMALIZED TO 72+-9 MB
  AT 500 KEV OF VOIGNIER ET AL./17/.  FOR JENDL-3.2, ABOVE 3
  MEV, A STRAIGHT LINE IN LOG-LOG SCALE WAS ADOPTED ASSUMING 1.0
  MILLI-BARN AT 14 MEV.
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 MT=251      MU-BAR
   CALCULATED WITH THE OPTICAL MODEL.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
      (MT=2, 51-58: THE SAME AS JENDL-3.1)
 MT=2
   CALCULATED WITH THE CASTHY CODE/9/.
 MT=51-58
   CALCULATED WITH THE COMBINED PROGRAM OF THE CASTHY/9/ AND
   ECIS/10/ CODES.
 MT=59-70
   TAKEN FROM JENDL FUSION FILE.
 MT=16, 17, 22, 28, 91
   TAKEN FROM JENDL FUSION FILE.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=16, 17, 22, 28, 91
   TAKEN FROM JENDL FUSION FILE.
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MAT number = 7434

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 74-W -183 KHI,NEDAC  EVAL-MAR87 T.WATANABE(KHI), T.ASAMI(NEDAC)
                      DIST-SEP89 REV2-JAN94
HISTORY
87-03 NEW EVALUATION WAS MADE FOR JENDL-3.
94-01 JENDL-3.2.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      ALL CROSS SECTIONS EXCEPT TOTAL
             THE INELASTIC SCATTERING, (N,2N), (N,3N), (N,NP),
             (N,NA), (N,P), (N,D) AND (N,A) CROSS SECTIONS WERE
             TAKEN FROM JENDL FUSION FILE.  FURTHER MODIFICATION
             WAS MADE FOR THE INELASTIC SCATTERING AND CAPTURE
             CROSS SECTIONS.
      (4,16-91), (5,16-91)
             THESE DATA WERE TAKEN FROM JENDL FUSION FILE.
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      JENDL FUSION FILE /1/  (AS OF JAN. 1994)
            EVALUATED BY K.KOSAKO (NEDAC) AND S.CHIBA (NDC/JAERI)
            COMPILED  BY K.KOSAKO.

      DATA WERE TAKEN FROM JENDL-3.1 EXCEPT FOR THE FOLLOWING:
      -  THE INELASTIC SCATTERING CROSS SECTIONS TO COTINUUM
         (MT=91) WAS CALCULATED WITH CASTHY2Y AND DWUCKY IN
         SINCROS-II SYSTEM/2/ INCLUDING CONTRIBUTIONS FROM DIRECT
         REACTIONS.
      -  THE (N,2N), (N,3N), (N,NA), (N,NP), (N,P), (N,D) AND
         (N,A) REACTION CROSS SECTIONS (MT=16, 17, 22, 28, 103,
         104, 107) WERE CALCULATED BY EGNASH2 IN THE SINCROS-II.
      -  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE REPLACED
         BY THOSE CALCULATED BY EGNASH2.  THE DDX'S OF THE
         CONTINUUM NEUTRONS WERE CALCULATED BY KUMABE'S SYSTEMA-
         TICS /3/ USING F15TOB /1/.  THE PRECOMPOUND/COMPOUND
         RATIO WAS CALCULATED BY THE SINCROS- II CODE SYSTEM.
      -  OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED IN
         THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./2/.
         LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/4/.
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MF=1  GENERAL INFORMATION
 MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
 MT=151  RESOLVED RESONANCE PARAMETERS
   RESOLVED PARAMETERS FOR MLBW FORMULA WERE GIVEN IN THE ENERGY
   REGION FROM 1.0E-5 EV TO 2.2 KEV.  PARAMETERS WERE EVALUATED BY
   EXAMINING BOTH THE EXPERIMENTAL DATA/5,6,7/ AND THE RECOMMENDED
   DATA OF BNL/8/.  FOR UNKNOWN RADIATIVE WIDTH, AN AVERAGE VALUE
   OF 55 MILLI-EV WAS ASSUMED.  PARAMETERS FOR A NEGATIVE
   RESONANCE WERE SELECTED SO THAT THE 2200 M/S CROSS SECTION FOR
   CAPTURE REPRODUCED GAVE A RECOMMENDED VALUE OF 10.2 BARNS/8/
   AND GAVE A GOOD FIT TO THE EXPERIMENTAL DATA FOR TOTAL CROSS
   SECTIONS AROUND THERMAL ENERGIES.  THE SCATTERING RADIUS WAS
   ASSUMED TO BE 7.3 FM.  CALCULATED 2200 M/SEC CROSS SECTIONS AND
   RESONANCE INTEGRALS ARE AS FOLLOWS:

          2200 M/S CROSS SECTION(B)     RES. INTEGRAL(B)
   ELASTIC        2.38
   CAPTURE       10.11                       335.
   TOTAL         12.49

MF=3  NEUTRON CROSS SECTIONS
   BELOW 2.2 KEV, ZERO BACKGROUND CROSS SECTION WAS GIVEN AND ALL
   THE CROSS-SECTION DATA ARE REPRODUCED FROM THE EVALUATED
   RESONANCE PARAMETERS WITH MLBW FORMULA.

   FOR JENDL-3.1, ABOVE 2.2 KEV, THE TOTAL AND PARTIAL CROSS
   SECTIONS WERE GIVEN MAINLY BASED ON THE THEORETICAL CALCULA-
   TIONS. THE TOTAL, ELASTIC AND INELASTIC SCATTERING, AND CAPTURE
   CROSS SECTIONS WERE CALCULATED WITH THE COUPLED-CHANNEL MODEL
   AND THE SPHERICAL OPTICAL-STATISTICAL MODEL.  THE CALCULATIONS
   WERE PERFORMED WITH A COMBINED PROGRAM OF CASTHY/9/ AND ECIS
   /10/.  THE SPHERICAL OPTICAL POTENTIAL PARAMETERS USED ARE:
         V = 48.83 - 0.0809*EN,    VSO = 5.6     (MEV)
        WS = 6.73 - 0.0536*EN,      WV = 0       (MEV)
         R = 1.168, RS = 1.268, RSO = 1.592      (FM)
         A = 0.617, ASO = 0.664, B = 0.563       (FM)
   THE DEFORMED POTENTIAL PARAMETERS WERE TAKEN FROM THE WORK OF
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   DELAROCHE/11/.

   FOR JENDL-3.2, ALL CROSS SECTION DATA EXCEPT FOR THE TOTAL,
   ELASTIC SCATTERING AND CAPTURE WERE ADOPTED FROM JENDL FUSION
   FILE.  THE CALCULATION WAS MADE WITH SINCROS-II SYSTEM/2/ BY
   ADOPTING WALTER-GUSS OMP MODIFIED BY YAMAMURO/2/ FOR NEUTRON,
   PEREY OMP /12/ FOR PROTON, LEMOS OMP MODIFIED BY ARTHUR AND
   YOUNG/13/ FOR ALPHA, LOHR-HAEBERLI OMP/14/ FOR DEUTERON,
   BECCHETTII-GREENLEES OMP/15/ FOR TRITON AND HE-3, AND STANDARD
   LEVEL DENSITY PARAMETERS OF SINCROS-II SYSTEM.

 MT=1 TOTAL
   CALCULATED WITH THE COMBINED PROGRAM OF THE ECIS AND CASTHY
   CODES.  ALMOST THE SAME AS JENDL-3.1.

 MT=2 ELASTIC SCATTERING
   OBTAINED BY SUBTRACTING THE SUM OF THE PARTIAL CROSS SECTIONS
   FROM THE TOTAL CROSS SECTION.

 MT=4, 51-60, 91 INELASTIC SCATTERING
   THE DATA OF MT=51 TO 60 WERE CALCULATED WITH THE COMBINED
   PROGRAM OF CASTHY /9/ AND ECIS/10/.  THESE CROSS SECTIONS IN
   JENDL-3.2 ARE THE SAME AS JENDL-3.1 EXCEPT THAT NEW CALCULATION
   WAS MADE AT ADDITIONAL SEVERAL ENERGY POINTS.  THE CROSS
   SECTION OF MT=91 WAS CALCULATED WITH SINCROS-II FOR JENDL
   FUSION FILE.  THE LEVEL SCHEME WAS BASED ON REF./4/
   CONTRIBUTIONS OF THE DIRECT PROCESS WERE CALCULATED FOR THE
   LEVELS MARKED WITH '*'.

       NO.  MT   ENERGY(MEV)     SPIN-PARITY (DIRECT PROCESS)
      G.S.         0.0             1/2 -
       1    51     0.0465          3/2 -          *
       2    52     0.0991          5/2 -          *
       3    53     0.2070          7/2 -          *
       4    54     0.2088          3/2 -
       5    55     0.2917          5/2 -
       6    56     0.3089          9/2 -          *
       7    57     0.3095         11/2 +
       8    58     0.4121          7/2 -
       9    58     0.4530          7/2 -
      10    59     0.4870         13/2 +
      11    59     0.5330          1/2 +
      12    60     0.5500          9/2 -
      13    60     0.5953          9/2 -
      14    60     0.6228          9/2 +
   LEVELS ABOVE 0.624 MEV WERE ASSUMED TO BE OVERLAPPING.  DATA OF
   LEVELS 8-9, 10-11 AND 12-14 WERE LUMPED AS IS INDICATED IN THE
   ABOVE TABLE.  THE DIRECT INELASTIC SCATTERING CROSS SECTION WAS
   CALCULATED ALSO FOR THE LEVELS AT 0.904, 0.935, 1.025, 1.485,
   1.866, 2.127, 2.505, 2.912, 3.404, 4.0, 4.5, 5.0 AND 5.5 MEV,
   AND ADDED TO MT=91.

 MT=16, 17, 22, 28, 103, 104, 107
        (N,2N), (N,3N), (N,NA), (N,NP), (N,P), (N,D), (N,A)
   ADOPTED FROM JENDL FUSION FILE.  THEORETICAL CALCULATION WAS
   MADE WITH SINCROS-II.  THE RESULTS WERE NORMALIZED TO
        (N,2N)    2.150 B AT 14.7 MEV (SYSTEMATICS OF QAIM/16/),
        (N,P)    0.0041 B AT 14.7 MEV MEASURED BY QAIM/16/,
   (N,D)+(N,NP)  0.0013 B AT 14.7 MEV MEASURED BY QAIM/16/,
        (N,A)    0.0018 B AT 14.7 MEV (SYSTEMATICS OF QAIM/16/).

 MT=102      CAPTURE
   CALCULATED WITH THE CASTHY CODE/9/ AND NORMALIZED TO 70+-9 MB
   AT 500 KEV/17/.  ABOVE 3 MEV, A STRAIGHT LINE IN LOG-LOG SCALE
   WAS ADOPTED ASSUMING 1.0 MB AT 14 MEV FOR JENDL-3.2.

 MT=251      MU-BAR
   CALCULATED WITH THE OPTICAL MODEL.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
      (MT=2, 51-60: THE SAME AS JENDL-3.1)
 MT=2
   CALCULATED WITH THE CASTHY CODE/9/.
 MT=51-60
   CALCULATED WITH THE COMBINED PROGRAM OF CASTHY/9/ AND
   ECIS/10/ CODES.
 MT=16, 17, 22, 28, 91
   TAKEN FROM JENDL FUSION FILE.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=16, 17, 22, 28, 91
   TAKEN FROM JENDL FUSION FILE.
```

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MAT number = 7437
 74-W -184 KHI,NEDAC  EVAL-MAR87 T.WATANABE(KHI), T.ASAMI(NEDAC)
                      DIST-SEP89 REV2-JAN94
HISTORY
87-03 NEW EVALUATION WAS MADE FOR JENDL-3.
87-03 COMPILED BY T.ASAMI.
94-01 JENDL-3.2.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      ALL CROSS SECTIONS EXCEPT TOTAL
             THE INELASTIC SCATTERING, (N,2N), (N,3N), (N,NP),
             (N,NA), (N,P), (N,D) AND (N,A) CROSS SECTIONS WERE
             TAKEN FROM JENDL FUSION FILE.  FURTHER MODIFICATION
             WAS MADE FOR THE INELASTIC SCATTERING AND CAPTURE
             CROSS SECTIONS.
      (4,16-91), (5,16-91)
             THESE DATA WERE TAKEN FROM JENDL FUSION FILE.
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      JENDL FUSION FILE /1/  (AS OF JAN. 1994)
            EVALUATED BY K.KOSAKO (NEDAC) AND S. CHIBA (NDC/JAERI)
            COMPILED  BY K.KOSAKO.

      DATA WERE TAKEN FROM JENDL-3.1 EXCEPT FOR THE FOLLOWING:
      -  THE INELASTIC SCATTERING CROSS SECTIONS TO COTINUUM
         (MT=91) WAS CALCULATED WITH CASTHY2Y AND DWUCKY IN
         SINCROS-II SYSTEM/2/ INCLUDING CONTRIBUTIONS FROM DIRECT
         REACTIONS.
      -  THE (N,2N), (N,3N), (N,NA), (N,NP), (N,P), (N,D) AND
         (N,A) REACTION CROSS SECTIONS (MT=16, 17, 22, 28, 103,
         104, 107) WERE CALCULATED BY EGNASH2 IN THE SINCROS-II.
      -  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE REPLACED
         BY THOSE CALCULATED BY EGNASH2.  THE DDX'S OF THE
         CONTINUUM NEUTRONS WERE CALCULATED BY KUMABE'S SYSTEMA-
         TICS /3/ USING F15TOB /1/.  THE PRECOMPOUND/COMPOUND
         RATIO WAS CALCULATED BY THE SINCROS- II CODE SYSTEM.
      -  OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED IN
         THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./2/.
         LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/4/.
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MF=1  GENERAL INFORMATION
 MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
 MT=151  RESOLVED RESONANCE PARAMETERS
   RESOLVED PARAMETERS FOR MLBW FORMULA WERE GIVEN IN THE ENERGY
   REGION FROM 1.0E-5 EV TO 12 KEV.  PARAMETERS WERE EVALUATED IN
   EXAMINING BOTH THE EXPERIMENTAL DATA/5,6,7/ AND THE RECOMMENDED
   DATA OF BNL/8/.  FOR UNKNOWN RADIATIVE WIDTH, AN AVERAGE VALUE
   OF 57 MILLI EV WAS ASSUMED.  PARAMETERS FOR NEGATIVE RESONANCE
   WERE SELECTED SO THAT THE 2200 M/S CROSS SECTION FOR CAPTURE
   REPRODUCED GAVE A RECOMMENDED VALUE OF 1.7 BARNS/8/ AND GAVE A
   GOOD FIT TO THE EXPERIMENTAL DATA FOR TOTAL CROSS SECTIONS
   AROUND THERMAL ENERGIES.  THE SCATTERING RADIUS WAS ASSUMED TO
   BE 7.5 FERMI.  CALCULATED 2200 M/SEC CROSS SECTIONS AND
   RESONANCE INTEGRALS ARE AS FOLLOWS:
           2200 M/S CROSS SECTION(B)     RES. INTEGRAL(BV)
   ELASTIC      7.35
   CAPTURE      1.70                        16.2
   TOTAL        9.05

MF=3  NEUTRON CROSS SECTIONS
   BELOW 12 KEV, NO BACKGROUND CROSS SECTION WAS GIVEN AND  ALL
   THE CROSS-SECTION DATA ARE REPRODUCED FROM THE EVALUATED
   RESOLVED RESONANCE PARAMETERS WITH MLBW FORMULA.

   FOR JENDL-3.1, ABOVE 12 KEV, THE TOTAL AND PARTIAL CROSS
   SECTIONS WERE GIVEN MAINLY BASED ON THE THEORETICAL CALCULA-
   TIONS. THE TOTAL, ELASTIC AND INELASTIC SCATTERING, AND CAPTURE
   CROSS SECTIONS WERE CALCULATED WITH THE COUPLED-CHANNEL MODEL
   AND THE SPHERICAL OPTICAL-STATISTICAL MODEL.  THE CALCULATIONS
   WERE PERFORMED WITH A COMBINED PROGRAM OF CASTHY/9/ AND ECIS
   /10/.  THE SPHERICAL OPTICAL POTENTIAL PARAMETERS USED ARE:
         V = 48.83 - 0.0809*EN,     VSO = 5.6     (MEV)
        WS = 6.73 - 0.0536*EN,       WV = 0       (MEV)
         R = 1.168, RS = 1.268, RSO = 1.592       (FM)
         A = 0.617, ASO = 0.664, B = 0.563        (FM)
   THE DEFORMED POTENTIAL PARAMETERS WERE TAKEN FROM THE WORK OF
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   DELAROCHE/11/.

   FOR JENDL-3.2, ALL CROSS SECTION DATA EXCEPT FOR THE TOTAL,
   ELASTIC SCATTERING AND CAPTURE WERE ADOPTED FROM JENDL FUSION
   FILE.  THE CALCULATION WAS MADE WITH SINCROS-II SYSTEM/2/ BY
   ADOPTING WALTER-GUSS OMP MODIFIED BY YAMAMURO/2/ FOR NEUTRON,
   PEREY OMP /12/ FOR PROTON, LEMOS OMP MODIFIED BY ARTHUR AND
   YOUNG/13/ FOR ALPHA, LOHR-HAEBERLI OMP/14/ FOR DEUTERON,
   BECCHETTII-GREENLEES OMP/15/ FOR TRITON AND HE-3, AND STANDARD
   LEVEL DENSITY PARAMETERS OF SINCROS-II SYSTEM.

 MT=1 TOTAL
   OPTICAL AND STATISTICAL MODEL CALCULATION WAS MADE WITH CASTHY
   CODE/9/. THE ABOVE-MENTIONED OMP WAS USED.  ALMOST THE SAME AS
   JENDL3.1.

 MT=2 ELASTIC SCATTERING
   OBTAINED BY SUBTRACTING THE SUM OF THE PARTIAL CROSS SECTIONS
   FROM THE TOTAL CROSS SECTION.

 MT=4, 51-60, 91 INELASTIC SCATTERING
   THE DATA OF MT=51 TO 60 WERE CALCULATED WITH THE COMBINED
   PROGRAM OF CASTHY /9/ AND ECIS/10/.  THESE CROSS SECTIONS IN
   JENDL-3.2 ARE THE SAME AS JENDL-3.1 EXCEPT THAT NEW CALCULATION
   WAS MADE AT ADDITIONAL SEVERAL ENERGY POINTS.  THE CROSS
   SECTION OF MT=91 WAS CALCULATED WITH SINCROS-II FOR JENDL
   FUSION FILE.  THE LEVEL SCHEME WAS BASED ON REF./4/
   CONTRIBUTIONS OF THE DIRECT PROCESS WERE CALCULATED FOR THE
   LEVELS MARKED WITH '*'.

       NO.  MT   ENERGY(MEV)     SPIN-PARITY (DIRECT PROCESS)
      G.S.        0.0                0+
       1    51    0.1112             2+         *
       2    52    0.3641             4+         *
       3    53    0.7483             6+         *
       4    54    0.9033             2+
       5    55    1.0023             0+
       6    56    1.0059             3+
       7    57    1.1214             2+
       8    57    1.1300             2-
       9    57    1.1338             4+
      10    58    1.2213             3-
      11    59    1.2850             5-
      12    59    1.2941             5+
      13    60    1.3221             0+
      14    60    1.3453             4-
      15    60    1.3590             4+
      16    60    1.3863             2+
      17    60    1.4250             3+
      18    60    1.4310             2+
   LEVELS ABOVE 1.4320 MEV WERE ASSUMED TO BE OVERLAPPING.  DATA
   OF LEVELS 7-9, 11-12 AND 13-18 WERE LUMPED AS IS INDICATED IN
   THE ABOVE TABLE.  THE DIRECT INELASTIC SCATTERING CROSS
   SECTION WAS CALCULATED ALSO FOR THE LEVELS AT 1.501, 1.861,
   2.126, 2.519, 2.919, 3.1, 3.455, 3.972, 4.5, 5.0 AND 5.5 MEV,
   AND ADDED TO MT=91.

 MT=16, 17, 22, 28, 103, 104, 107
        (N,2N), (N,3N), (N,NA), (N,NP), (N,P), (N,D), (N,A)
   ADOPTED FROM JENDL FUSION FILE.  THEORETICAL CALCULATION WAS
   MADE WITH SINCROS-II.  THE RESULTS WERE NORMALIZED TO
        (N,2N)    2.162 B AT 14.7 MEV (SYSTEMATICS OF QAIM/16/),
                  1.93  B AT 14.  MEV MEASURED BY FREHAUT/17/,
        (N,3N)    0.022 B AT 14.76MEV MEASURED BY FREHAUT/17/,
        (N,P)   0.00334 B AT 14.96MEV MEASURED BY IKEDA/18/,
                0.0029  B AT 14.7 MEV MEASURED BY QAIM/16/,
  (N,D)+(N,NP)  0.00065 B AT 14.7 MEV MEASURED BY QAIM/16/,
        (N,A)   0.00079 B AT 14.28MEV MEASURED BY KASUGAI/19/,
                0.00115 B AT 14.7 MEV MEASURED BY QAIM/16/.

 MT=102      CAPTURE
   CALCULATED WITH THE CASTHY CODE/9/ AND NORMALIZED TO 49+-6 MB
   AT 500 KEV/20/.  ABOVE 3 MEV, A STRAIGHT LINE IN LOG-LOG SCALE
   WAS ADOPTED ASSUMING 1.0 MB AT 14 MEV FOR JENDL-3.2.

 MT=251      MU-BAR
   CALCULATED WITH THE OPTICAL MODEL.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
      (MT=2, 51-60: THE SAME AS JENDL-3.1)
 MT=2
   CALCULATED WITH THE CASTHY CODE/9/.
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 MT=51-60
   CALCULATED WITH THE COMBINED PROGRAM OF THE CASTHY/9/ AND
   ECIS/10/ CODES.
 MT=16, 17, 22, 28, 91
   TAKEN FROM JENDL FUSION FILE.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=16, 17, 22, 28, 91
   TAKEN FROM JENDL FUSION FILE.
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 3) KUMABE, I. ET AL.: NUCL. SCI. ENG., 104, 280 (1990).
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 5) CAMARDA H.S. ET AL. : PHYS. REV. C8, 1813 (1973).
 6) OHKUBO  M. : JAERI-M 5624 (1974).
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 8) MUGHABGHAB S.F. AND GARBER D.I. :"NEUTRON CROSS SECTIONS",
    VOL. 2, PART B (1984).
 9) IGARASI S. AND FUKAHORI T.: JAREI 1321 (1991).
10) RAYNAL J. : IAEA-SMR-9/8 P.281 (1972).
11) DELAROCHE J.F. ET AL. : 1979 KNOXVILLE CONF. 336 (1979).
12) PEREY F.G.: PHYS. REV., 131, 745 (1963).
13) ARTHUR, E.D. AND YOUNG, P.G.: LA-8626-MS (1980).
14) LOHR J.M. AND HAEBERLI W.: NUCL. PHYS., A232, 381 (1974).
15) BECCHETTI F.D. JR. AND GREENLEES G.W.: "POLARIZATION
   PHENOMENA IN NUCL. REACTIONS," UNIV. WISCONSIN PRESS, P.682
   (1971).
16) QAIM S.M. AND GRACA  C.: NUCL. PHYS., A242, 317 (1975).
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   P.399 (1980).
18) IKEDA Y. ET AL.: JAERI 1312 (1988).
19) KASUGAI Y. ET AL.: JAERI-M 93-046, P.277 (1993).
20) VOIGNIER J. ET AL.: NUCL. SCI. ENG., 93, 43 (1986).
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MAT number = 7443
 74-W -186 KHI,NEDAC  EVAL-MAR87 T.WATANABE(KHI), T.ASAMI(NEDAC)
                      DIST-SEP89 REV2-JAN94
HISTORY
87-03 NEW EVALUATION WAS MADE FOR JENDL-3.
87-03 COMPILED BY T.ASAMI.
94-01 JENDL-3.2.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      ALL CROSS SECTIONS EXCEPT TOTAL
             THE INELASTIC SCATTERING, (N,2N), (N,3N), (N,NP),
             (N,NA), (N,P), (N,D) AND (N,A) CROSS SECTIONS WERE
             TAKEN FROM JENDL FUSION FILE.  FURTHER MODIFICATION
             WAS MADE FOR THE INELASTIC SCATTERING AND CAPTURE
             CROSS SECTIONS.
      (4,16-91), (5,16-91)
             THESE DATA WERE TAKEN FROM JENDL FUSION FILE.
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      JENDL FUSION FILE /1/  (AS OF JAN. 1994)
            EVALUATED BY K.KOSAKO (NEDAC) AND S. CHIBA (NDC/JAERI)
            COMPILED  BY K.KOSAKO.

      DATA WERE TAKEN FROM JENDL-3.1 EXCEPT FOR THE FOLLOWING:
      -  THE INELASTIC SCATTERING CROSS SECTIONS TO COTINUUM
         (MT=91) WAS CALCULATED WITH CASTHY2Y AND DWUCKY IN
         SINCROS-II SYSTEM/2/ INCLUDING CONTRIBUTIONS FROM DIRECT
         REACTIONS.
      -  THE (N,2N), (N,3N), (N,NA), (N,NP), (N,P), (N,D) AND
         (N,A) REACTION CROSS SECTIONS (MT=16, 17, 22, 28, 103,
         104, 107) WERE CALCULATED BY EGNASH2 IN THE SINCROS-II.
      -  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE REPLACED
         BY THOSE CALCULATED BY EGNASH2.  THE DDX'S OF THE
         CONTINUUM NEUTRONS WERE CALCULATED BY KUMABE'S SYSTEMA-
         TICS /3/ USING F15TOB /1/.  THE PRECOMPOUND/COMPOUND
         RATIO WAS CALCULATED BY THE SINCROS- II CODE SYSTEM.
      -  OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED IN
         THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./2/.
         LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/4/.
     -------------------------------------------------------------


MF=1  GENERAL INFORMATION
 MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
 MT=151  RESOLVED RESONANCE PARAMETERS
    RESOLVED PARAMETERS FOR MLBW FORMULA WERE GIVEN IN THE ENERGY
    REGION FROM 1.0E-5 EV TO 12 KEV.  PARAMETERS WERE EVALUATED IN
    EXAMINING BOTH THE EXPERIMENTAL DATA/5,6,7/ AND THE
    RECOMMENDED DATA OF BNL/8/.  FOR UNKNOWN RADIATIVE WIDTH, AN
    AVERAGE VALUE OF 60 MILLI-EV WAS ASSUMED.  PARAMETERS FOR
    NEGATIVE RESONANCE WERE SELECTED SO THAT THE 2200 M/S CROSS
    SECTION FOR CAPTURE REPRODUCED GAVE A RECOMMENDED VALUE OF
    37.8 BARNS/8/ AND GAVE A GOOD FIT TO THE EXPERIMENTAL DATA FOR
    TOTAL CROSS SECTIONS AROUND THERMAL ENERGIES.  THE SCATTERING
    RADIUS WAS ASSUMED TO BE 7.64 FERMI/8/.  CALCULATED 2200 M/SEC
    CROSS SECTIONS AND RESONANCE INTEGRALS ARE AS FOLLOWS:
            2200 M/S CROSS SECTION(B)     RES. INTEGRAL(B)
    ELASTIC      0.14
    CAPTURE     37.89                          347.
    TOTAL       38.03

MF=3  NEUTRON CROSS SECTIONS
   BELOW 12 KEV, ZERO BACKGROUND CROSS SECTION WAS GIVEN AND  ALL
   THE CROSS-SECTION DATA ARE REPRODUCED FROM THE EVALUATED
   RESOLVED RESONANCE PARAMETERS WITH MLBW FORMULA.

   FOR JENDL-3.1, ABOVE 12 KEV, THE TOTAL AND PARTIAL CROSS
   SECTIONS WERE GIVEN MAINLY BASED ON THE THEORETICAL CALCULA-
   TIONS. THE TOTAL, ELASTIC AND INELASTIC SCATTERING, AND CAPTURE
   CROSS SECTIONS WERE CALCULATED WITH THE COUPLED-CHANNEL MODEL
   AND THE SPHERICAL OPTICAL-STATISTICAL MODEL.  THE CALCULATIONS
   WERE PERFORMED WITH A COMBINED PROGRAM OF CASTHY/9/ AND ECIS
   /10/.  THE SPHERICAL OPTICAL POTENTIAL PARAMETERS USED ARE:
         V = 48.83 - 0.0809*EN,    VSO = 5.6    (MEV)
        WS = 6.73 - 0.0536*EN,      WV = 0      (MEV)
         R = 1.168, RS = 1.268, RSO = 1.592     (FM)
         A = 0.617, ASO = 0.664, B = 0.563      (FM)
   THE DEFORMED POTENTIAL PARAMETERS WERE TAKEN FROM THE WORK OF
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    DELAROCHE/11/.

    FOR JENDL-3.2, ALL CROSS SECTION DATA EXCEPT FOR THE TOTAL,
    ELASTIC SCATTERING AND CAPTURE WERE ADOPTED FROM JENDL FUSION
    FILE.  THE CALCULATION WAS MADE WITH SINCROS-II SYSTEM/2/ BY
    ADOPTING WALTER-GUSS OMP MODIFIED BY YAMAMURO/2/ FOR NEUTRON,
    PEREY OMP /12/ FOR PROTON, LEMOS OMP MODIFIED BY ARTHUR AND
    YOUNG/13/ FOR ALPHA, LOHR-HAEBERLI OMP/14/ FOR DEUTERON,
    BECCHETTII-GREENLEES OMP/15/ FOR TRITON AND HE-3, AND
    STANDARD LEVEL DENSITY PARAMETERS OF SINCROS-II SYSTEM.

  MT=1 TOTAL
    OPTICAL AND STATISTICAL MODEL CALCULATION WAS MADE WITH CASTHY
    CODE/9/. THE ABOVE-MENTIONED OMP WAS USED.  ALMOST THE SAME AS
    JENDL-3.1.

  MT=2 ELASTIC SCATTERING
    OBTAINED BY SUBTRACTING THE SUM OF THE PARTIAL CROSS SECTIONS
    FROM THE TOTAL CROSS SECTION.

  MT=4, 51-62, 91 INELASTIC SCATTERING
    THE DATA OF MT=51 TO 62 WERE CALCULATED WITH THE COMBINED
    PROGRAM OF CASTHY /9/ AND ECIS/10/.  THESE CROSS SECTIONS IN
    JENDL-3.2 ARE THE SAME AS JENDL-3.1 EXCEPT THAT NEW CALCULATION
    WAS MADE AT ADDITIONAL SEVERAL ENERGY POINTS.  THE CROSS
    SECTION OF MT=91 WAS CALCULATED WITH SINCROS-II FOR JENDL
    FUSION FILE.  THE LEVEL SCHEME WAS BASED ON REF./4/
    CONTRIBUTIONS OF THE DIRECT PROCESS WERE CALCULATED FOR THE
    LEVELS MARKED WITH '*'.

        NO.  MT   ENERGY(MEV)     SPIN-PARITY (DIRECT PROCESS)
       G.S.        0.0                0+
        1    51    0.1226             2+          *
        2    52    0.3968             4+          *
        3    53    0.7377             2+
        4    54    0.8088             6+          *
        5    55    0.8618             3+
        6    56    0.8820             0+
        7    57    0.9526             2-
        8    58    1.0070             2+
        9    59    1.0316             4+
       10    60    1.0452             3-
       11    61    1.1500             0+
       12    62    1.2840             2+
       13    62    1.2980             2+
       14    62    1.3220             2+
    LEVELS ABOVE 1.323 MEV WERE ASSUMED TO BE OVERLAPPING.  DATA
    GIVEN IN MT=62 ARE SUM OF CROSS SECTIONS OF 12TH - 14TH LEVELS.
    THE DIRECT INELASTIC SCATTERING CROSS SECTION WAS CALCULATED
    ALSO FOR THE LEVELS AT 1.384, 2.002, 2.588, 3.0, 3.5, 4.0, 5.0,
    5.5 AND 6.0 MEV, AND ADDED TO MT=91.

  MT=16, 17, 22, 28, 103, 104, 107
         (N,2N), (N,3N), (N,NA), (N,NP), (N,P), (N,D), (N,A)
    ADOPTED FROM JENDL FUSION FILE.  THEORETICAL CALCULATION WAS
    MADE WITH SINCROS-II.  THE RESULTS WERE NORMALIZED TO
         (N,2N)    2.272 B AT 14.7 MEV MEASURED BY QAIM/16/,
                   1.9   B AT 14.  MEV MEASURED BY FREHAUT/17/,
         (N,3N)    0.058 B AT 14.76MEV MEASURED BY FREHAUT/17/,
         (N,P)    0.0014 B AT 14.7 MEV MEASURED BY QAIM/16/,
   (N,D)+(N,NP) 0.00025 B AT 14.7 MEV MEASURED BY QAIM/16/,
                0.00034 B AT 14.87MEV MEASURED BY KASUGAI/18/,
         (N,A)  0.00076 B AT 14.87MEV MEASURED BY KASUGAI/18/,
                0.00055 B AT 14.7 MEV MEASURED BY QAIM/16/.

  MT=102      CAPTURE
    CALCULATED WITH THE CASTHY CODE/9/ AND NORMALIZED TO 49+-6 MB
    AT 500 KEV/19/.  ABOVE 3 MEV, A STRAIGHT LINE IN LOG-LOG SCALE
    WAS ADOPTED ASSUMING 1.0 MB AT 14 MEV (BASED ON EXPERIMENTAL
    DATA STORED IN EXFOR) FOR JENDL-3.2.

  MT=251      MU-BAR
    CALCULATED WITH THE OPTICAL MODEL.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
      (MT=2, 51-62: THE SAME AS JENDL-3.1)
  MT=2
    CALCULATED WITH THE CASTHY CODE/9/.
  MT=51-62
    CALCULATED WITH THE COMBINED PROGRAM OF THE CASTHY/9/ AND
    ECIS/10/ CODES.
  MT=16, 17, 22, 28, 91
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   TAKEN FROM JENDL FUSION FILE.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=16, 17, 22, 28, 91
   TAKEN FROM JENDL FUSION FILE.
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 8) MUGHABGHAB S.F. AND GARBER D.I. :"NEUTRON CROSS SECTIONS",
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10) RAYNAL J. : IAEA-SMR-9/8 P.281 (1972).
11) DELAROCHE J.F. ET AL. : 1979 KNOXVILLE CONF. 336 (1979).
12) PEREY F.G.: PHYS. REV., 131, 745 (1963).
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14) LOHR J.M. AND HAEBERLI W.: NUCL. PHYS., A232, 381 (1974).
15) BECCHETTI F.D. JR. AND GREENLEES G.W.: "POLARIZATION
   PHENOMENA IN NUCL. REACTIONS," UNIV. WISCONSIN PRESS, P.682
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16) QAIM S.M. AND GRACA  C.: NUCL. PHYS., A242, 317 (1975).
17) FREHAUT J. ET AL.: 1980 BNL SYMPOSIUM, BNL-NCS-51245, VOL. 1,
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18) KASUGAI Y. ET AL.: JAERI-M 93-046, P.277 (1993).
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MAT number = 8200

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 82-PB-  0 JAERI      EVAL-JUL87 M.MIZUMOTO
                      DIST-SEP89 REV2-JUN94
HISTORY
87-03  NEWLY EVALUATED FOR JENDL-3 BY M.MIZUMOTO (JAERI)
87-11  REVISION IS RECOMMENDED.
89-09  REVISION IS COMPLETED.
       COMPILATION WAS MADE BY. T.NARITA AND T.FUKAHORI (JAERI)
94-06 JENDL-3.2.
       RESONANCE PARAMETERS CORRECTED BY T.NAKAGAWA
       DATA FOR MF=3,4,5 WERE ADOPTED FROM JENDL FUSION FILE
       GAMMA-RAY PRODUCTION DATA MODIFIED BY K.SHIBATA(JAERI)
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (3,4), (3,16). (3,17), (3,22), (3,28), (3,51-91)
      (4,16-91), (5,16-91)
             THESE DATA WERE TAKEN FROM JENDL FUSION FILE.
      (2,151)  REICH-MOORE FORMULA ADOPTED FOR PB-204, 206 AND
             208.  UPPER BOUNDARIES OF RESONANCE REGIONS WERE
             CHANGED.
      (3,1)  BELOW 1 MEV
      (3,102)
      (3,2)  TO COMPANSATE THE ABOVE MODIFICATIONS
      (12,102), (13,3), (13,4), (15,3), (15,102)
     ***********************************************************

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      JENDL FUSION FILE /1/  (AS OF OCT. 1993)
            EVALUATED BY K.KOSAKO (NEDAC) AND S.CHIBA (NDC/JAERI)
            COMPILED  BY K.KOSAKO.

      DATA WERE TAKEN FROM JENDL-3.1 EXCEPT FOR THE FOLLOWING:
     -  THE INELASTIC SCATTERING CROSS SECTIONS AND ANGULAR
        DISTRIBUTIONS OF INELASTICALLY SCATTERED NEUTRONS (EXCEPT
        CONTINUUM INELASTIC) WERE CALCULATED WITH CASTHY2Y AND
        DWUCKY IN SINCROS-II SYSTEM/2/ INCLUDING CONTRIBUTIONS
        FROM DIRECT REACTIONS.
     -  THE (N,2N), (N,3N), (N,NA) AND (N,NP) REACTION CROSS
        SECTIONS (MT=16, 17, 22, 28) WERE CALCULATED BY EGNASH2
        IN THE SINCROS-II. THE (N,2N) CROSS SECTION WAS
        RENORMALIZED TO EXPERIMENTAL DATA.
     -  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE REPLACED
        WITH THOSE CALCULATED BY EGNASH2.  THE DDX'S OF THE
        CONTINUUM NEUTRONS WERE CALCULATED BY KUMABE'S SYSTEMA-
        TICS /3/ USING F15TOB /1/.  THE PRECOMPOUND/COMPOUND
        RATIO WAS CALCULATED BY THE SINCROS-II CODE SYSTEM.
     -  OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED IN
        THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./2/.
        LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/4/.
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MF=1  GENERAL INFORMATION
 MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
 MT=151  RESOLVED RESONANCE PARAMETERS
  RESONANCE RANGES AND FORMULA
    PB-204: 1.0E-5 EV TO  50 KEV, MLBW
    PB-206: 1.0E-5 EV TO 500 KEV, REICH-MOORE
    PB-207: 1.0E-5 EV TO 475 KEV, REICH-MOORE
    PB-208: 1.0E-5 EV TO   1 MEV, REICH-MOORE
  PARAMETERS WERE EVALUATED FROM THE FOLLOWING EXPERIMENTAL DATA
  AND RECOMMENDATION BY MUGHABGHAB/5/.
    PB-204: HOREN+84 /6/
    PB-206: HOREN+79 /7/, MIZUMOTO+79 /8/
    PB-207: HOREN+78 /9/
    PB-208: HOREN+86 /10/

     CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS.
                     2200 M/S             RES. INTEG.
      ELASTIC         11.073 B                -
      CAPTURE          0.174 B              0.143 B
      TOTAL           11.248 B                -

MF=3  NEUTRON CROSS SECTIONS
  BELOW 1 MEV, BACKGROUND CROSS SECTIONS ARE GIVEN.

  FOR JENDL-3.2, THE THRESHOLD REACTION CROSS SECTIONS WERE
  ADOPTED FROM JENDL FUSION FILE.  THEIR CALCULATION WAS MADE WITH
  SINCROS-II SYSTEM/2/ BY ADOPTING WALTER-GUSS OMP MODIFIED BY
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YAMAMURO/2/ FOR NEUTRONS, LEMOS OMP MODIFIED BY ARTHUR AND YOUNG/11/ FOR ALPHA, THE SAME OMP'S AS THE PEGASUS CALCULATION FOR OTHER CHARGED PARTICLES AND STANDARD LEVEL DENSITY PARAMETERS OF SINCROS-II SYSTEM. DATA FOT NATURAL PB WERE CONSTRUCTED FROM DATA FOR ISOTOPES.

MT=1 TOTAL
CROSS SECTIONS IN THE ENERGY RANGE FROM 1 TO 15 MEV WERE OBTAINED BASED ON THE EXPERIMENTAL DATA OF SCHWARTZ+74 /12/. ABOVE 15 MEV, CROSS SECTIONS WERE CALCULATED WITH AN OPTICAL AND STATISTICAL MODEL CODE CASTHY /13/. THE OPTICAL POTENTIAL PARAMETERS WERE OBTAINED BY FITTING AVERAGE TOTAL CROSS SECTION OF NATURAL LEAD AS FOLLOWS,

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     V=47.0 - 0.250*E,  WS = 2.30 + 0.41*E, VSO = 6.0 (MEV)
     R0 = 1.25       ,  RS = 1.30         , RSO = 1.30 (FM)
     A0 = 0.65       ,  B  = 0.48         , ASO = 0.689 (FM)
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LEVEL DENSITY PARAMETERS WERE DETERMINED USING LOW-LYING LEVEL DATA AND OBSERVED NEUTRON RESONANCE SPACING.

MT=2 ELASTIC SCATTERING
(TOTAL)-(ALL OTHER PARTIAL CROSS SECTIONS)

MT=4,51-90,91 INELASTIC SCATTERING
TAKEN FROM JENDL FUSION FILE. THE LEVEL SCHEME WAS TAKEN FROM REF./4/. THE DATA FOR SOME LEVELS WERE LUMPED AS FOLLOWS:

MT	ENERGY(MEV)	PB-204	PB-206	PB-207	PB-208
51	0.5697			51	
52	0.8031		51		
53	0.8977	51		52	
54	1.165		52		
55	1.2739	52			
56	1.3405	53	53		
57	1.467		54		
58	1.5631	54-56			
59	1.6334			53	
60	1.665	57			
61	1.682	58	55		
62	1.703	59	56		
63	1.7619	60,61	57		
64	1.9977		58		
65	2.149		59		
66	2.2002		60		
67	2.315		61	54	
68	2.379		62-64		
69	2.424		65		
70	2.6146				51
71	2.6232			55,56	
72	2.703			57,58	
73	3.1977				52
74	3.4751				53
75	3.7087				54
76	3.9198				55,56
77	3.961				57,58
78	4.037				59-61
79	4.0854				62
80	4.106				63,64
81	4.141				65,66
82	4.1804				67
83	4.2054				68
84	4.2295				69,70
85	4.2535				71
86	4.2624				72
87	4.296				73
91	1.817	91	91	91	91

MT=16, 17, 22, 28 (N,2N), (N,3N), (N,NA), (N,NP)
ADOPTED FROM JENDL FUSION FILE. THEORETICAL CALCULATION WAS MADE WITH SINCROS-II. THE (N,2N) CROSS SECTION WAS ADJUSTED TO REPRODUCE THE MEASURED ENARGY SPECTRA/14/ (FACTOR = 1.2). THE DATA OF SIMAKOV ET AL. /15/ WERE ALSO TAKEN INTO CONSIDERATION.

MT=102 CAPTURE
CALCULATED WITH CASTHY /13/ FOR PB-204, PB-206 AND PB-207. FOR PB-208, ESTIMATED FROM THE EXPERIMENTAL DATA. THE CAPTURE CROSS SECTION OF NATURAL LEAD WAS CONSTRUCTED FROM THESE ISOTOPES. Q-VALUE IS WEIGHTED AVERAGE OF Q-VALUES OF ISOTOPES.

MT=103, 107 (N,P), (N,A)
CALCULATED WITH GNASH /16/ FOR EACH ISOTOPE AND CONSTRUCTED ACCORDING TO THEIR ABUNDANCES.

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 MT=251 MU-BAR
  CALCULATED WITH CASTHY /13/.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=2
  CALCULATED WITH CASTHY /13/.
 MT=51-87
  TAKEN FROM JENDL FUSION FILE WHICH  WERE CONSTRUCTED FROM
  ISOTOPE DATA CALCULATED WITH SINCROS-II(CASTHY AND DWUCKY).
 MT=16,17,22,28,91
  ADOPTED FROM JENDL FUSION FILE.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=16,17,22,28,91
  ADOPTED FROM JENDL FUSION FILE.

MF=12 GAMMA-RAY MULTIPLICITY PRODUCED BY NEUTRON REACTIONS
 MT=102 (BLELOW 1.8 MEV)
  CALCULATED FROM ENERGY BALANCE.

MF=13 GAMMA-RAY PRODUCTION CROSS SECTIONS
 MT=3 (ABOVE 1.8 MEV)
  CALCULATED WITH GNASH /16/ FOR EACH ISOTOPE AND CONSTRUCTED
  ACCORDING TO THEIR ABUNDANCES.
 MT=4 (BELOW 1.8 MEV)
  CALCULATED FROM INELASTIC SCATTERING CROSS SECTIONS AND
  TRANSITION PROBABILITIES OF ISOTOPES.

MF=14 ANGULAR DISTRIBUTIONS OF SECONDARY GAMMA-RAYS
 MT=3, 4, 102 : ASSUMED ISOTROPIC.

MF=15 ENERGY DISTRIBUTION OF SECONDARY GAMMA-RAYS
 MT=3  (ABOVE 1.8 MEV)
  CALCULATED WITH GNASH /16/ FOR EACH ISOTOPE AND CONSTRUCTED
  ACCORDING TO THEIR ABUNDANCES.
  ABOVE 10 MEV, THE CALCULATED SPECTRA WERE MODIFIED SO AS TO
  REPRODUCE THE MEASUREMENTS OF CHAPMAN ET AL./17/
 MT=102 (BELOW 1.8 MEV)
  CALCULATED WITH CASTHY/13/.

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MAT number = 8225

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 82-PB-204 JAERI      EVAL-JUL87 M.MIZUMOTO
                      DIST-SEP89 REV2-APR94
HISTORY
87-03 NEWLY EVALUATED FOR JENDL-3 BY M. MIZUMOTO (JAERI)
87-11 REVISE IS RECOMMENDED.
89-09 REVISION IS COMPLETED.
      COMPILATION WAS MADE BY T. NARITA AND T.FUKAHORI (JAERI)
94-04 JENDL-3.2.
        BY ADOPTING THE DATA FROM JENDL FUSION FILE
        GAMMA-RAY PRODUCTION DATA MODIFIED BY K.SHIBATA(JAERI)
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (3,2), (3,4), (3,16). (3,17), (3,22), (3,28), (3,51-91)
      (4,16-91), (5,16-91)
             THESE DATA WERE TAKEN FROM JENDL FUSION FILE.
      (12,102)  FROM ENERGY BALANCE
      (15,102)  SPECTRUM AT 1.0E-5 EV
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      JENDL FUSION FILE /1/  (AS OF OCT. 1993)
            EVALUATED BY K.KOSAKO (NEDAC) AND S.CHIBA (NDC/JAERI)
            COMPILED  BY K.KOSAKO.

      DATA WERE TAKEN FROM JENDL-3.1 EXCEPT FOR THE FOLLOWING:
      -  THE INELASTIC SCATTERING CROSS SECTIONS AND ANGULAR
         DISTRIBUTIONS OF INELASTICALLY SCATTERED NEUTRONS (EXCEPT
         CONTINUUM INELASTIC) WERE CALCULATED WITH CASTHY2Y AND
         DWUCKY IN SINCROS-II SYSTEM/2/ INCLUDING CONTRIBUTIONS
         FROM DIRECT REACTIONS.
      -  THE (N,2N), (N,3N), (N,NA) AND (N,NP) REACTION CROSS
         SECTIONS (MT=16, 17, 22, 28) WERE CALCULATED BY EGNASH2
         IN THE SINCROS-II. THE (N,2N) CROSS SECTION WAS
         RENORMALIZED TO EXPERIMENTAL DATA.
      -  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE REPLACED
         WITH THOSE CALCULATED BY EGNASH2.  THE DDX'S OF THE
         CONTINUUM NEUTRONS WERE CALCULATED BY KUMABE'S SYSTEMA-
         TICS /3/ USING F15TOB /1/.  THE PRECOMPOUND/COMPOUND
         RATIO WAS CALCULATED BY THE SINCROS-II CODE SYSTEM.
      -  OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED IN
         THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./2/.
         LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/4/.
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MF=1  GENERAL INFORMATION
 MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
 MT=151  RESOLVED RESONANCE PARAMETERS FOR MLBW FORMULA
  RESONANCE RANGES: 1.0E-5 EV TO 50 KEV
  PARAMETERS WERE EVALUATED FROM THE DATA OF HOREN+84 /5/.
  EFFECTIVE SCATTERING RADIUS OF 8.5 FM WAS SELECTED.

       CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS.
                   2200 M/S               RES. INTEG.
      ELASTIC      11.197 B                   -
      CAPTURE       0.661 B                1.848 B
      TOTAL        11.857 B                   -

MF=3  NEUTRON CROSS SECTIONS
 BELOW 50 KEV
  BACKGROUND CROSS SECTIONS ARE GIVEN FOR THE ELASTIC SCATTERING
  AND CAPTURE CROSS SECTIONS.

 ABOVE 50 KEV
  CROSS SECTIONS FOR JENDL-3.1 WERE OBTAINED FROM OPTICAL AND
  STATISTICAL MODEL CALCULATIONS.  THE OPTICAL POTENTIAL PARAME-
  TERS WERE OBTAINED BY FITTING AVERAGE TOTAL CROSS SECTION OF
  NATURAL LEAD:
       V=47.0 - 0.250*E,  WS = 2.30 + 0.41*E, VSO = 6.0 (MEV)
       R0 = 1.25       ,  RS = 1.30         , RSO = 1.30 (FM)
       A0 = 0.65       ,  B=0.48            , ASO = 0.689 (FM)
  LEVEL DENSITY PARAMETERS WERE DETERMINED USING LOW-LYING LEVEL
  DATA AND OBSERVED NEUTRON RESONANCE SPACING.

  FOR JENDL-3.2, THE (N,2N), (N,3N), (N,NA), (N,NP) AND INELASTIC
  SCATTERING CROSS SECTIONS WERE ADOPTED FROM JENDL FUSION FILE.
  THEY WERE CALCULATED WITH SINCROS-II SYSTEM/2/ BY ADOPTING
  WALTER-GUSS OMP MODIFIED BY YAMAMURO/2/ FOR NEUTRON, PEREY OMP
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  /6/ FOR PROTON, LEMOS OMP MODIFIED BY ARTHUR AND YOUNG/7/ FOR
  ALPHA, LOHR-HAEBERLI OMP/8/ FOR DEUTERON, BECCHETTII-GREENLEES
  OMP/9/ FOR TRITON AND HE-3, AND STANDARD LEVEL DENSITY
  PARAMETERS OF SINCROS-II SYSTEM.

  THE DATA OF TOTAL, CAPTURE, (N,P), (N,D) AND (N,A) CROSS
  SECTIONS ARE THE SAME AS JENDL-3.1.

 MT=1  TOTAL
  CALCULATED WITH OPTICAL AND STATISTICAL MODE CODE CASTHY /10/

 MT=2  ELASTIC SCATTERING
  (TOTAL)-(ALL OTHER PARTIAL CROSS SECTIONS)

 MT=4,51-61,91  INELASTIC SCATTERING
  THE CROSS SECTIONS WERE TAKEN FROM JENDL FUSION FILE.  THE LEVEL
  SCHEME WAS ADOPTTED FROM REF./4/  CONTRIBUTIONS OF THE DIRECT
  PROCESS WERE CALCULATED FOR THE LEVELS MARKED WITH '*', USING
  DEFORMATION PARAMETERS COMPILED BY RAMAN ET AL./11/ AND
  SPEAR/12/.
         NO.     ENERGY(MEV)    SPIN-PARITY (DIRECT PROCESS)
         G.S.     0.0              0.0 +
           1      0.8992           2.0 +         *
           2      1.2739           4.0 +         *
           3      1.3514           2.0 +         *
           4      1.5631           4.0 +         *
           5      1.5836           0.0 +
           6      1.6047           3.0 +
           7      1.665            2.0 +         *
           8      1.682            1.0 +
           9      1.73             0.0 +
          10      1.7619           1.0 -
          11      1.8173           4.0 +         *
  LEVELS ABOVE 1.817 MEV WERE ASSUMED TO BE CONTINUUM.

 MT=16, 17, 22, 28        (N,2N), (N,3N), (N,NA), (N,NP)
  ADOPTED FROM JENDL FUSION FILE.  THEORETICAL CALCULATION WAS
  MADE WITH SINCROS-II.  THE (N,2N) CROSS SECTION WAS NORMALIZED
  TO 2.12 B AT 13.98 MEV MEASURED BY IKEDA ET AL./13/,

 MT=102 CAPTURE
  CALCULATED WITH CASTHY /10/.

 MT=103, 107   (N,P), (N,A)
  CALCULATED WITH GNASH /14/.

 MT=251 MU-BAR
  CALCULATED WITH CASTHY /10/.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=2
   CALCULATED WITH CASTHY /10/.
 MT=51-61
   TAKEN FROM JENDL FUSION FILE.  CALCULATED WITH THE CASTHY AND
   DWUCKY IN THE SINCROS-II SYSTEM.
 MT=16, 17, 22, 28, 91
   TAKEN FROM JENDL FUSION FILE.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=16, 17, 22, 28, 91
   TAKEN FROM JENDL FUSION FILE.

MF=12 GAMMA-RAY MULTIPLICITY PRODUCED BY NEUTRON REACTIONS
  MT=16,17,22,91
    CALCULATED WITH GNASH /14/.
  MT=51-61
    TRANSITION PROBABILITIES WERE GIVEN.
  MT=102
    FROM ENERGY BALANCE.

MF=14 ANGULAR DISTRIBUTIONS OF SECONDARY GAMMA-RAYS
  MT=16,17,51-61,22,91,102: ASSUMED TO BE ISOTROPIC.

MF=15 ENERGY DISTRIBUTION OF SECONDARY GAMMA-RAYS
  MT=16,17,91,102: CALCULATED WITH THE GNASH /14/.

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MAT number = 8231
 82-PB-206 JAERI       EVAL-JUL87 M.MIZUMOTO
                       DIST-SEP89 REV2-APR94
HISTORY
87-03  NEWLY EVALUATED FOR JENDL-3 BY M.MIZUMOTO (JAERI)
87-11  REVISE IS RECOMMENDED.
89-09  REVISION IS COMPLETED.
       COMPILATION IS MADE BY T.NARITA AND T.FUKAHORI (JAERI)
94-04 JENDL-3.2.
        MF2:  REICH-MOORE FORMULA ADOPTED.
        MF3, 4, 5:  BY ADOPTING THE DATA FROM JENDL FUSION FILE
        MF12,15:  MODIFIED BY K.SHIBATA(JAERI)
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (3,4), (3,16), (3,17), (3,22), (3,28), (3,51-91)
      (4,16-91), (5,16-91)
             THESE DATA WERE TAKEN FROM JENDL FUSION FILE.
      (2,151)  REICH-MOORE FORMULA ADOPTED
      (3,102)  RENORMALIZED
      (3,2)
      (12,102), (15,102)  CALCULATED WITH CASTHY
     ***********************************************************

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      JENDL FUSION FILE /1/  (AS OF OCT. 1993)
            EVALUATED BY K.KOSAKO (NEDAC) AND S.CHIBA (NDC/JAERI)
            COMPILED  BY K.KOSAKO.

      DATA WERE TAKEN FROM JENDL-3.1 EXCEPT FOR THE FOLLOWING:
      -  THE INELASTIC SCATTERING CROSS SECTIONS AND ANGULAR
         DISTRIBUTIONS OF INELASTICALLY SCATTERED NEUTRONS (EXCEPT
         CONTINUUM INELASTIC) WERE CALCULATED WITH CASTHY2Y AND
         DWUCKY IN SINCROS-II SYSTEM/2/ INCLUDING CONTRIBUTIONS
         FROM DIRECT REACTIONS.
      -  THE (N,2N), (N,3N), (N,NA) AND (N,NP) REACTION CROSS
         SECTIONS (MT=16, 17, 22, 28) WERE CALCULATED BY EGNASH2
         IN THE SINCROS-II. THE (N,2N) CROSS SECTION WAS
         RENORMALIZED TO EXPERIMENTAL DATA.
      -  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE REPLACED
         WITH THOSE CALCULATED BY EGNASH2.  THE DDX'S OF THE
         CONTINUUM NEUTRONS WERE CALCULATED BY KUMABE'S SYSTEMA-
         TICS /3/ USING F15TOB /1/.  THE PRECOMPOUND/COMPOUND
         RATIO WAS CALCULATED BY THE SINCROS-II CODE SYSTEM.
      -  OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED IN
         THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./2/.
         LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/4/.
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MF=1  GENERAL INFORMATION
 MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
 MT=151  RESOLVED RESONANCE PARAMETERS FOR REICH-MOORE FORMULA
  RESONANCE RANGE: 1.0E-5 EV TO 500 KEV
  PARAMETERS WERE EVALUATED FROM THE DATA OF HOREN+79 /5/, AND
  MIZUMOTO+79 /6/.  VALUES OF RADIATIVE WIDTH WERE TAKEN FROM
  REF./7/.  EFFECTIVE SCATTERING RADIUS OF 8.042 FM AND DUMMY
  RESONANCES AT -4 AND 8 MEV WERE ADOPTED FROM REF./5/.

     CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS.
                    2200 M/S              RES. INTEG.
      ELASTIC       10.035  B                 -
      CAPTURE        0.0306 B              0.1108 B
      TOTAL         10.066  B                 -

MF=3  NEUTRON CROSS SECTIONS
 BELOW 500 KEV
  NO BACKGROUND CROSS SECTIONS ARE GIVEN.

 ABOVE 500 KEV
  CROSS SECTIONS FOR JENDL-3.1 WERE OBTAINED FROM OPTICAL AND
  STATISTICAL MODEL CALCULATIONS.  THE OPTICAL POTENTIAL
  PARAMETERS WERE OBTAINED BY FITTING AVERAGE TOTAL CROSS SECTION
  OF NATURAL LEAD:
       V=47.0 - 0.250*E,  WS = 2.30 + 0.41*E, VSO = 6.0 (MEV)
       R0 = 1.25       ,  RS = 1.30         , RSO = 1.30 (FM)
       A0 = 0.65       ,  B=0.48            , ASO = 0.689 (FM)
  LEVEL DENSITY PARAMETERS WERE DETERMINED USING LOW-LYING LEVEL
  DATA AND OBSERVED NEUTRON RESONANCE SPACING.
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  FOR JENDL-3.2, THE (N,2N), (N,3N), (N,NA), (N,NP) AND INELASTIC
  SCATTERING CROSS SECTIONS WERE ADOPTED FROM JENDL FUSION FILE.
  THEY WERE CALCULATED WITH SINCROS-II SYSTEM/2/ BY ADOPTING
  WALTER-GUSS OMP MODIFIED BY YAMAMURO/2/ FOR NEUTRON, PEREY OMP
  /8/ FOR PROTON, LEMOS OMP MODIFIED BY ARTHUR AND YOUNG/9/ FOR
  ALPHA, LOHR-HAEBERLI OMP/10/ FOR DEUTERON, BECCHETTII-GREENLEES
  OMP/11/ FOR TRITON AND HE-3, AND STANDARD LEVEL DENSITY
  PARAMETERS OF SINCROS-II SYSTEM.

  THE DATA OF TOTAL, CAPTURE, (N,P), (N,D) AND (N,A) CROSS
  SECTIONS ARE THE SAME AS JENDL-3.1.

 MT=1  TOTAL
  CALCULATED WITH OPTICAL AND STATISTICAL MODE CODE CASTHY /12/

 MT=2  ELASTIC SCATTERING
  (TOTAL)-(ALL OTHER PARTIAL CROSS SECTIONS)

 MT=4,51-65.91  INELASTIC SCATTERING
  THE CROSS SECTIONS WERE TAKEN FROM JENDL FUSION FILE.  THE LEVEL
  SCHEME WAS ADOPTTED FROM REF./4/  CONTRIBUTIONS OF THE DIRECT
  PROCESS WERE CALCULATED FOR THE LEVELS MARKED WITH '*', USING
  DEFORMATION PARAMETERS COMPILED BY RAMAN ET AL./13/ AND
  SPEAR/14/.
         NO.      ENERGY(MEV)    SPIN-PARITY (DIRECT PROCESS)
         G.S.      0.0              0.0 +
          1        0.8031           2.0 +         *
          2        1.1650           0.0 +
          3        1.3405           3.0 +         *
          4        1.467            2.0 +
          5        1.6841           4.0 +         *
          6        1.703            1.0 +
          7        1.784            2.0 +         *
          8        1.9977           4.0 +         *
          9        2.149            2.0 +
         10        2.2002           7.0 -         *
         11        2.315            0.0 +
         12        2.379            4.0 +
         13        2.3842           6.0 -
         14        2.3914           4.0 +
         15        2.424            2.0 +
  LEVELS ABOVE 2.424 MEV WERE ASSUMED TO BE CONTINUUM.  THE
  DIRECT INELASTIC SCATTERING CROSS SECTIONS WERE CALCULATED FOR
  THE LEVELS AT 2.648, 3.014, 3.774, 4.114, 4.33, 5.261, 6.103
  AND 6.187 MEV, AND ADDED TO MT=91.

 MT=16, 17, 22, 28        (N,2N), (N,3N), (N,NA), (N,NP)
  ADOPTED FROM JENDL FUSION FILE.  THEORETICAL CALCULATION WAS
  MADE WITH SINCROS-II.  THE (N,2N) CROSS SECTION WAS ADJUSTED TO
  REPRODUCE THE MEASURED ENARGY SPECTRA/15/ (FACTOR = 1.2).  THE
  DATA OF SIMAKOV ET AL. /16/ WERE ALSO TAKEN INTO CONSIDERATION.

 MT=102 CAPTURE
  CALCULATED WITH CASTHY /12/, AND NORMALIZED TO 0.0085 B AT AT 50
  KEV WHICH WAS AN AVERAGE VALUE OBTAINED FROM THE RESONANCE
  PARAMETERS.

 MT=103 (N,P)
  CALCULATED WITH GNASH /17/ AND NORMALIZED TO 2.0 MB AT 14.5 MEV
  BY BELOVICKIJ+76 18/.

 MT=107 (N,A)
  CALCULATED WITH GNASH /17/ AND MULTIPLIED BY 5.

 MT=251 MU-BAR
  CALCULATED WITH CASTHY /12/.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=2
   CALCULATED WITH CASTHY /12/.
 MT=51-65
   TAKEN FROM JENDL FUSION FILE.  CALCULATED WITH THE CASTHY AND
   DWUCKY IN THE SINCROS-II SYSTEM.
 MT=16, 17, 22, 28, 91
   TAKEN FROM JENDL FUSION FILE.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=16, 17, 22, 28, 91
   TAKEN FROM JENDL FUSION FILE.

MF=12 GAMMA-RAY MULTIPLICITY PRODUCED BY NEUTRON REACTIONS
 MT=16,17,22,28,91,103,107
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    CALCULATED WITH GNASH /17/.
 MT=51-65
    TRANSITION PROBABILITIES ARE GIVEN.
 M=102
    CALCULATED WITH CASTHY /12/.  MULTIPLICITY OF A LINE SPECTRUM
    AT THERMAL IS 1.0.

MF=14 ANGULAR DISTRIBUTIONS OF SECONDARY GAMMA-RAYS
 MT=16,17,22,28,51-65,91,102,103,107 : ASSUMED ISOTROPIC.

MF=15 ENERGY DISTRIBUTION OF SECONDARY GAMMA-RAYS
 MT=16,17,22,28,91,107
    CALCULATED WITH THE GNASH /17/.
 M=102
    CALCULATED WITH CASTHY /12/.  AT THERMAL, A LINE SPECTRUM OF
    6.73835 MEV WAS ASSUMED.
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14) SPEAR, R.H.: ATOM. DATA AND NUCL. DATA TABLE, 42, 55 (1989).
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    TECHNOL., DEL MAR, MAR 3-6 (1993).
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MAT number = 8234
 82-PB-207 JAERI       EVAL-JUL87 M.MIZUMOTO
                       DIST-SEP89 REV2-APR94
HISTORY
87-03 NEWLY EVALUATED FOR JENDL-3 BY M.MIZUMOTO (JAERI)
87-11 REVISE IS RECOMMENDED.
89-09 REVISION IS COMPLETED
      COMPILATION IS MADE BY T.NARITA AND T.FUKAHORI (JAERI)
94-04 JENDL-3.2.
       RESONANCE PARAMETERS CORRECTED BY T.NAKAGAWA
       DATA FOR MF=3,4,5 WERE ADOPTED FROM JENDL FUSION FILE
       GAMMA-RAY PRODUCTION DATA MODIFIED BY K.SHIBATA(JAERI)
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (3,4), (3,16). (3,17), (3,22), (3,28), (3,51-91)
      (4,16-91), (5,16-91)
             THESE DATA WERE TAKEN FROM JENDL FUSION FILE.
      (2,151)  REICH-MOORE FORMULA ADOPTED, AND UPPER BOUNDARY
             OF RESONANCE REGION WAS CHANGED FROM 500 TO 475 KEV
      (3,102)  RENORMALIZED
      (3,107)  0 AT 500 KEV WAS INSERTED
      (3,2)
      (12,102), (15,102)  CALCULATED WITH CASTHY
     ***********************************************************

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      JENDL FUSION FILE /1/  (AS OF OCT. 1993)
            EVALUATED BY K.KOSAKO (NEDAC) AND S.CHIBA (NDC/JAERI)
            COMPILED  BY K.KOSAKO.

      DATA WERE TAKEN FROM JENDL-3.1 EXCEPT FOR THE FOLLOWING:
      -  THE INELASTIC SCATTERING CROSS SECTIONS AND ANGULAR
         DISTRIBUTIONS OF INELASTICALLY SCATTERED NEUTRONS (EXCEPT
         CONTINUUM INELASTIC) WERE CALCULATED WITH CASTHY2Y AND
         DWUCKY IN SINCROS-II SYSTEM/2/ INCLUDING CONTRIBUTIONS
         FROM DIRECT REACTIONS.
      -  THE (N,2N), (N,3N), (N,NA) AND (N,NP) REACTION CROSS
         SECTIONS (MT=16, 17, 22, 28) WERE CALCULATED BY EGNASH2
         IN THE SINCROS-II. THE (N,2N) CROSS SECTION WAS
         RENORMALIZED TO EXPERIMENTAL DATA.
      -  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE REPLACED
         WITH THOSE CALCULATED BY EGNASH2.  THE DDX'S OF THE
         CONTINUUM NEUTRONS WERE CALCULATED BY KUMABE'S SYSTEMA-
         TICS /3/ USING F15TOB /1/.  THE PRECOMPOUND/COMPOUND
         RATIO WAS CALCULATED BY THE SINCROS-II CODE SYSTEM.
      -  OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED IN
         THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./2/.
         LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/4/.
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MF=1  GENERAL INFORMATION
 MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
 MT=151  RESOLVED RESONANCE PARAMETERS FOR REICH-MOORE FORMULA
  RESONANCE RANGES: 1.0E-5 EV TO 475 KEV
  PARAMETERS WERE BASED ON THE DATA OF HOREN+78 /5/ AND RECOMMEN-
  DATION OF MUGHABGHAB/6/ PARAMETERS OF DUMMY RESONANCES WERE
  TAKEN FROM ENDF/B-VI EVALUATION/7/.  AVERAGE RADIATIVE WIDTH OF
  0.11 EV WAS USED FOR THE RESONANCES WHOSE VALUE WAS UNKNOWN.
  EFFECTIVE SCATTERING RADIUS OF 9.53 FM WAS DETERMINED TO
  REPRODUCE WELL THE EXPERIMENTAL DATA OF TOTAL CROSS SECTION.

     CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS.
                   2200 M/S            RES. INTEG.
      ELASTIC      11.254B                -
      CAPTURE      0.7120 B             0.3911 B
      TOTAL        11.966 B               -

MF=3  NEUTRON CROSS SECTIONS
 BELOW 475 KEV
  NO BACKGROUND CROSS SECTIONS ARE GIVEN.

 ABOVE 475 KEV
  CROSS SECTIONS FOR JENDL-3.1 WERE OBTAINED WITH OPTICAL AND
  STATISTICAL MODEL CODE CASTHY /8/.  THE OPTICAL POTENTIAL
  PARAMETERS WERE OBTAINED BY FITTING AVERAGE TOTAL CROSS SECTION
  OF NATURAL LEAD.
       V=47.0 - 0.250*E,  WS = 2.30 + 0.41*E, VSO = 6.0 (MEV)
       R0 = 1.25       ,  RS = 1.30         , RSO = 1.30 (FM)
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     A0 = 0.65        ,   B=0.48            , AS0 = 0.689 (FM)
 LEVEL DENSITY PARAMETERS WERE DETERMINED USING LOW-LYING LEVEL
 DATA AND OBSERVED NEUTRON RESONANCE SPACING.

 FOR JENDL-3.2, THE (N,2N), (N,3N), (N,NA), (N,NP) AND INELASTIC
 SCATTERING CROSS SECTIONS WERE ADOPTED FROM JENDL FUSION FILE.
 THEY WERE CALCULATED WITH SINCROS-II SYSTEM/2/ BY ADOPTING
 WALTER-GUSS OMP MODIFIED BY YAMAMURO/2/ FOR NEUTRON, PEREY OMP
 /9/ FOR PROTON, LEMOS OMP MODIFIED BY ARTHUR AND YOUNG/10/ FOR
 ALPHA, LOHR-HAEBERLI OMP/11/ FOR DEUTERON, BECCHETTII-GREENLEES
 OMP/12/ FOR TRITON AND HE-3, AND STANDARD LEVEL DENSITY
 PARAMETERS OF SINCROS-II SYSTEM.

MT=1  TOTAL
 CALCULATED WITH CASTHY /8/.

MT=2  ELASTIC SCATTERING
 (TOTAL)-(ALL OTHER PARTIAL CROSS SECTIONS)

MT=4,51-58,91  INELASTIC SCATTERING
 THE CROSS SECTIONS WERE TAKEN FROM JENDL FUSION FILE.  THE LEVEL
 SCHEME WAS ADOPTTED FROM REF./4/  CONTRIBUTIONS OF THE DIRECT
 PROCESS WERE CALCULATED FOR THE LEVELS MARKED WITH '*'.
        NO.      ENERGY(MEV)    SPIN-PARITY (DIRECT PROCESS)
        G.S.      0.0            1/2 -
         1        0.5697         5/2 -        *
         2        0.8977         3/2 -        *
         3        1.6334        13/2 +
         4        2.3399         7/2 -        *
         5        2.6232         5/2 +        *
         6        2.6624         7/2 +
         7        2.7030         7/2 +
         8        2.7280         9/2 +
 LEVELS ABOVE 2.728 MEV WERE ASSUMED TO BE CONTINUUM.  THE DIRECT
 INELASTIC SCATTERING CROSS SECTIONS WERE CALCULATED FOR THE
 LEVELS AT 3.384, 3.509, 3.583, 3.62, 3.901, 4.103, 4.14, 4.19,
 4.313, 4.364, 4.404, 4.627, 5.081, 5.352 AND 6.188 MEV, AND
 ADDED TO MT=91.

MT=16, 17, 22, 28        (N,2N), (N,3N), (N,NA), (N,NP)
 ADOPTED FROM JENDL FUSION FILE.  THEORETICAL CALCULATION WAS
 MADE WITH SINCROS-II.  THE (N,2N) CROSS SECTION WAS ADJUSTED TO
 REPRODUCE THE MEASURED ENARGY SPECTRA/13/ (FACTOR = 1.2).  THE
 DATA OF SIMAKOV ET AL. /14/ WERE ALSO TAKEN INTO CONSIDERATION.

MT=102 CAPTURE
 CALCULATED WITH CASTHY /8/ AND NORMALIZED TO A 30 KEV
 MAXWELLIAN SPECTRUM AVERAGE OF 0.011 B/15/.

MT=103 (N,P)
 CALCULATED WITH GNASH /16/ AND NORMALIZED TO 1.6 MB AT 14.5 MEV
 BY BELOVICKIJ+76 /17/

MT=107 (N,A)
 CALCULATED WITH GNASH /16/ AND MULTIPLIED BY 5.

MT=251 MU-BAR
 CALCULATED WITH CASTHY /5/.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=2
   CALCULATED WITH CASTHY /5/.
 MT=51-58
   TAKEN FROM JENDL FUSION FILE.  CALCULATED WITH THE CASTHY AND
   DWUCKY IN THE SINCROS-II SYSTEM.
 MT=16, 17, 22, 28, 91
   TAKEN FROM JENDL FUSION FILE.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=16, 17, 22, 28, 91
   TAKEN FROM JENDL FUSION FILE.

MF=12 GAMMA-RAY MULTIPLICITY PRODUCED BY NEUTRON REACTIONS
 MT=16,17,22,28,91,103,107
    CALCULATED WITH GNASH /18/.
 MT=51-58
    TRANSITION PROBABILITIES ARE GIVEN.
 M=102
    CALCULATED WITH CASTHY /5/.  MULTIPLICITY OF A LINE SPECTRUM
    AT THERMAL IS 1.0.

MF=14 ANGULAR DISTRIBUTIONS OF SECONDARY GAMMA-RAYS
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MT=16,17,22,28,51-58,91,102,103,107 : ASSUMED ISOTROPIC.

MF=15 ENERGY DISTRIBUTION OF SECONDARY GAMMA-RAYS
MT=16,17,22,28,91,107
CALCULATED WITH THE GNASH /18/.
M=102
CALCULATED WITH CASTHY /5/. AT THERMAL, A LINE SPECTRUM OF
7.36735 MEV WAS ASSUMED.

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MAT number = 8237

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 82-PB-208 JAERI      EVAL-JUL87 M.MIZUMOTO
                      DIST-SEP89 REV2-JUN94
HISTORY
87-03  NEWLY EVALUATED FOR JENDL-3 BY M.MIZUMOTO (JAERI)
87-11  REVISION IS RECOMMENDED.
89-09  REVISION IS COMPLETED.
       COMPILATION IS MADE BY T.NARITA AND T.FUKAHORI (JAERI)
94-06 JENDL-3.2.
       RESONANCE PARAMETERS CORRECTED BY T.NAKAGAWA
       DATA FOR MF=3,4,5 WERE ADOPTED FROM JENDL FUSION FILE
       GAMMA-RAY PRODUCTION DATA MODIFIED BY K.SHIBATA(JAERI)
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   *******************
      (3,4), (3,16). (3,17), (3,22), (3,51-91)
      (4,16-91), (5,16-91)
             THESE DATA WERE TAKEN FROM JENDL FUSION FILE.
      (2,151)  REICH-MOORE FORMULA ADOPTED, AND UPPER BOUNDARY
             OF RESONANCE REGION WAS CHANGED FROM 0.8 TO 1 MEV
      (3,2)
      (12,102), (15,102)
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      JENDL FUSION FILE /1/  (AS OF OCT. 1993)
            EVALUATED BY K.KOSAKO (NEDAC) AND S.CHIBA (NDC/JAERI)
            COMPILED  BY K.KOSAKO.

      DATA WERE TAKEN FROM JENDL-3.1 EXCEPT FOR THE FOLLOWING:
      -  THE INELASTIC SCATTERING CROSS SECTIONS AND ANGULAR
         DISTRIBUTIONS OF INELASTICALLY SCATTERED NEUTRONS (EXCEPT
         CONTINUUM INELASTIC) WERE CALCULATED WITH CASTHY2Y AND
         DWUCKY IN SINCROS-II SYSTEM/2/ INCLUDING CONTRIBUTIONS
         FROM DIRECT REACTIONS.
      -  THE (N,2N), (N,3N), (N,NA) AND (N,NP) REACTION CROSS
         SECTIONS (MT=16, 17, 22, 28) WERE CALCULATED BY EGNASH2
         IN THE SINCROS-II. THE (N,2N) CROSS SECTION WAS
         RENORMALIZED TO EXPERIMENTAL DATA.
      -  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS WERE REPLACED
         WITH THOSE CALCULATED BY EGNASH2.  THE DDX'S OF THE
         CONTINUUM NEUTRONS WERE CALCULATED BY KUMABE'S SYSTEMA-
         TICS /3/ USING F15TOB /1/.  THE PRECOMPOUND/COMPOUND
         RATIO WAS CALCULATED BY THE SINCROS-II CODE SYSTEM.
      -  OPTICAL-MODEL, LEVEL DENSITY AND OTHER PARAMETERS USED IN
         THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./2/.
         LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/4/.
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MF=1  GENERAL INFORMATION
 MT=451  DESCRIPTIVE DATA AND DICTIONARY

MF=2  RESONANCE PARAMETERS
 MT=151 RESOLVED RESONANCE PARAMETERS FOR REICH-MOORE FORMULA
  RESONANCE RANGES: 1.0E-5 EV TO 1.0 MEV
  PARAMETERS WERE ADOPTED FROM HOREN+86 /5/ AND MUGHABGHAB/6/.
  AVERAGE RADIATIVE WIDTH OF 0.18 EV WAS USED FOR THE RESONANCES
  WHOSE VALUE WAS UNKNOWN.  EFFECTIVE SCATTERING RADIUS OF 9.69
  FM/5/ WAS ADOPTED.  BACKGROUND CROSS SECTIONS WERE GIVEN TO
  REPRODUCE THE LOW ENERGY TOTAL CROSS SECTION MEASURED AT KYOTO
  UNIVERSITY/7/ AND THE TOTAL CROSS SECTION MEASURED BY HOREN ET
  AL./5/ IN THE 100-460 KEV REGION.

       CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS.
                     2200 M/S               RES. INTEG.
        ELASTIC       11.471 B                  -
        CAPTURE       0.5007 MB              6.755 MB
        TOTAL         11.472 B

MF=3  NEUTRON CROSS SECTIONS
 BELOW 1 MEV
  BCKGROUND CROSS SECTIONS ARE GIVEN TO THE TOTAL AND ELASTIC
  SCATTERING CROSS SECTIONS.

 ABOVE 1 MEV
  CROSS SECTIONS OF JENDL-3.1 WERE OBTAINED WITH AN OPTICAL AND
  STATISTICAL MODEL CALCULATION CODE CASTHY /8/.  THE OPTICAL
  POTENTIAL PARAMETERS WERE OBTAINED BY FITTING AVERAGE TOTAL
  CROSS SECTION OF NATURAL LEAD AS FOLLOWS,
       V=47.0 - 0.250*E,  WS = 2.30 + 0.41*E, VSO = 6.0 (MEV)
       R0 = 1.25       ,  RS = 1.30         , RSO = 1.30 (FM)
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A0 = 0.65 , B=0.48 , ASO = 0.689 (FM)
LEVEL DENSITY PARAMETERS WERE DETERMINED USING LOW-LYING LEVEL DATA AND OBSERVED NEUTRON RESONANCE SPACING.

FOR JENDL-3.2, THE (N,2N), (N,3N), (N,NA) AND INELASTIC SCATTERING CROSS SECTIONS WERE ADOPTED FROM JENDL FUSION FILE. THEY WERE CALCULATED WITH SINCROS-II SYSTEM/2/ BY ADOPTING WALTER-GUSS OMP MODIFIED BY YAMAMURO/2/ FOR NEUTRON, PEREY OMP /9/ FOR PROTON, LEMOS OMP MODIFIED BY ARTHUR AND YOUNG/10/ FOR ALPHA, LOHR-HAEBERLI OMP/11/ FOR DEUTERON, BECCHETTII-GREENLEES OMP/12/ FOR TRITON AND HE-3, AND STANDARD LEVEL DENSITY PARAMETERS OF SINCROS-II SYSTEM.

MT=1 TOTAL
CALCULATED WITH CASTHY /8/.

MT=2 ELASTIC SCATTERING
(TOTAL)-(ALL OTHER PARTIAL CROSS SECTIONS)

MT=4,51-73,91 INELASTIC SCATTERING
THE CROSS SECTIONS WERE TAKEN FROM JENDL FUSION FILE. THE LEVEL SCHEME WAS ADOPTTED FROM REF./4/ CONTRIBUTIONS OF THE DIRECT PROCESS WERE CALCULATED FOR THE LEVELS MARKED WITH '*'.

NO.	ENERGY(MEV)	SPIN-PARITY	(DIRECT PROCESS)
G.S.	0.0	0 +	
1	2.6146	3 -	*
2	3.1977	5 -	*
3	3.4751	4 -	
4	3.7087	5 -	*
5	3.9198	6 -	
6	3.9464	4 -	
7	3.9610	5 -	
8	3.9957	5 -	
9	4.0370	7 -	
10	4.0450	5 -	
11	4.0505	3 -	
12	4.0854	2 +	*
13	4.1060	3 -	
14	4.1253	4 -	
15	4.1410	2 +	
16	4.1590	5 -	
17	4.1804	5 -	
18	4.2054	6 -	
19	4.2295	2 -	
20	4.2300	4 -	
21	4.2535	3 -	
22	4.2624	5 -	
23	4.2960	5 -	*

LEVELS ABOVE 4.296 MEV WERE ASSUMED TO BE CONTINUUM. THE DIRECT INELASTIC SCATTERING CROSS SECTIONS WERE CALCULATED FOR THE LEVELS AT 4.3237, 4.4235, 4.698, 4.973, 5.087, 5.242, 5.345, 5.483, 5.514, 5.542, 5.689, 5.813, 5.993, 6.688 AND 7.019 MEV, AND ADDED TO MT=91.

MT=16, 17, 22 (N,2N), (N,3N), (N,NA)
ADOPTED FROM JENDL FUSION FILE. THEORETICAL CALCULATION WAS MADE WITH SINCROS-II. THE (N,2N) CROSS SECTION WAS ADJUSTED TO REPRODUCE THE MEASURED ENARGY SPECTRA/13/ (FACTOR = 1.2). THE DATA OF SIMAKOV ET AL. /14/ WERE ALSO TAKEN INTO CONSIDERATION.

MT=28 (N,N'P)
CALCULATED WITH GNASH /15/ AND NORMALIZED TO 26 MB AT 20 MEV BY WELCH+81 /16/.

MT=102 CAPTURE
ESTIMATED FROM THE EXPERIMENTAL DATA BY CSIKAI+67 /17/, DRAKE+71 /18/, BERGQVIST+72 /19/, DIVEN+60 /20/ AND LEIPUNSKIJ+58 /21/.

MT=103 (N,P)
CALCULATED WITH GNASH /15/ AND NORMALIZED TO 4 MB AT 18 MEV BY BASS+68 /22/.

MT=107 (N,ALPHA)
CALCULATED WITH GNASH /15/ AND NORMALIZED TO 1.6 MB AT 14.5 BY COLEMAN+59 /23/.

MT=251 MU-BAR
CALCULATED WITH CASTHY /8/.

MF=4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=2

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   CALCULATED WITH CASTHY /8/.
 MT=51-73
   TAKEN FROM JENDL FUSION FILE.  CALCULATED WITH THE CASTHY AND
   DWUCKY IN THE SINCROS-II SYSTEM.
 MT=16, 17, 22, 28, 91
   TAKEN FROM JENDL FUSION FILE.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=16, 17, 22, 28, 91
   TAKEN FROM JENDL FUSION FILE.

MF=12 GAMMA-RAY MULTIPLICITY PRODUCED BY NEUTRON REACTIONS
 MT=16,17,22,28,91,103,107
    CALCULATED WITH GNASH /15/.
 MT=51-73
    TRANSITION PROBABILITIES ARE GIVEN.
 M=102
    FROM ENERGY BALANCE.

MF=14 ANGULAR DISTRIBUTIONS OF SECONDARY GAMMA-RAYS
 MT=16,17,22,28,51-73,91,102,103,107 : ASSUMED ISOTROPIC.

MF=15 ENERGY DISTRIBUTION OF SECONDARY GAMMA-RAYS
 MT=16,17,22,28,91,107
    CALCULATED WITH THE GNASH /15/.
 M=102
    CALCULATED WITH CASTHY /8/.
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MAT number = 8325

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 83-BI-209 JAERI       EVAL-MAY89 N.YAMAMURO,A.ZUKERAN,JENDL-3 C.G.
                       DIST-SEP89 REV2-FEV94
HISTORY
89-04  EVALUATION WAS PERFORMED FOR JENDL-3.
89-05  COMPILED BY K.SHIBATA AND T.NARITA (JAERI).
94-02  JENDL-3.2.
       COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (3,2), (3,4), (3,58)  AROUND 3 MEV.
      (4,16-91), (5,16-91)  TAKEN FROM JENDL FUSION FILE.
      (12,102)              FROM ENERGY BALANCE.
     ***********************************************************

     ---------------------------------------------------------------
      JENDL FUSION FILE /1/  (AS OF SEP. 1993)
            EVALUATED AND COMPILED BY S. CHIBA (NDC/JAERI)

      DATA WERE TAKEN FROM JENDL-3.1 EXCEPT FOR THE FOLLOWING:
            THE NEUTRON ENERGY DISTRIBUTIONS OF MT=16, 17, 22, 28
        AND 91 WERE REPLACED WITH CALCULATED VALUES WITH SNICROS-
        II/2/.  HOWEVER, THOSE OF MT=16 AND 91 ABOVE 17 MEV WERE
        TAKEN FROM JEND L-3.1 BECAUSE THEY REPRODUCED THE DATA
        MEASURED BY MATSUYAMA ET AL./3/ AT 18 MEV BETTER THAN THE
        SINCROS-II CALCULATION.  THE ANGULAR DISTRIBUTIONS OF
        CONTINUUM NEUTRONS WERE CREATED BY F15TOB/1/.  THE MSD/MSC
        RATIO WAS TAKEN FROM THE SINCROS-II CALCULATION, AND
        KUMABE'S SYSTEMATICS/4/ WAS USED.
           OPTICAL-MODEL, LEVEL-DENSITY AND OTHER PARAMETERS USED
         IN THE SINCROS-II CALCULATION ARE DESCRIBED IN REF./2/.
        LEVEL SCHEMES WERE DETERMINED ON THE BASIS OF ENSDF/5/.
     ---------------------------------------------------------------


MF=1          GENERAL INFORMATION
  MT=451    DESCRIPTIVE DATA AND DICTIONARY

MF=2          RESONANCE PARAMETERS
  MT=151    RESOLVED RESONANCE PARAMETERS FOR MLBW FORMULA
     PARAMETERS WERE MAINLY TAKEN FROM THE WORK OF MUGHABGHAB
     ET AL. /6/.
     RESONANCE REGION : 1.0E-5 EV TO 200 KEV.
     SCATTERING RADIUS: 9.68 FM
     CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS
                  2200-M/S         RES. INTEG.
      ELASTIC     9.298 B              -
      CAPTURE     0.034 B           0.207 B
      TOTAL       9.331 B              -

MF=3          NEUTRON CROSS SECTIONS
  MT=1        TOTAL
        BELOW 200 KEV   : BACKGROUND CROSS SECTIONS GIVEN BETWEEN
                          30 KEV AND 200 KEV.
        200 KEV TO 20 MEV: BASED ON THE EXPERIMENTAL DATA
                           /7,8,9/.
  MT=2        ELASTIC SCATTERING
        (TOTAL) - (REACTION CROSS SECTION)
  MT=3        NON ELASTIC
        SUM OF MT=4, 16, 17, 22, 28, 102, 103, 104, 107
  MT=4,51-62,91 INELASTIC SCATTERING
        STATISTICAL MODEL CALCULATIONS WERE MADE WITH THE SINCROS
        SYSTEM /2/ USING THE MODIFIED WALTER-GUSS POTENTIAL
        PARAMETERS FOR NEUTRONS.  FOR MT=51,52,58,62, THE EXPERI-
        MENTAL DATA OF SMITH ET AL./10/ WERE ADOPTED BELOW 5 MEV.
        THE CALCULATED CROSS SECTION OF MT=91 WAS MODIFIED SO AS
        TO REPRODUCE THE MEASUREMENTS OF THE TOTAL INELASTIC CROSS
        SECTION BELOW 8 MEV.  THE DIRECT-PROCESS COMPONENTS WERE
        CONSIDERED FOR THE LEVELS OF MT=51,52,58,91 BY THE DWBA
        CALCULATIONS.

        THE LEVEL SCHEME IS GIVEN AS FOLLOWS:
          NO.     ENERGY(MEV) SPIN-PARITY
          G.S.      0.0         9/2 -
           1.       0.8964      7/2 -
           2.       1.6085     13/2 +
           3.       2.4300      1/2 +
           4.       2.4920      3/2 +
           5.       2.5645      9/2 +
           6.       2.5830      7/2 +
           7.       2.5990     11/2 +
           8.       2.6017     13/2 +
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       9.        2.6170      5/2 +
      10.        2.7411     15/2 +
      11.        2.7660      5/2 +
      12.        2.8220      5/2 -

     LEVELS ABOVE 2.85 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT=16,17,22,28,103,104,107 (N,2N),(N,3N),(N,N'A),(N,N'P),(N,P)
     (N,D) AND (N,A) CROSS SECTIONS
        CALCULATED WITH SINCROS/2/.  OPTICAL POTENTIAL PARAMETERS
        FOR PROTON, ALPHA-PARTICLE AND DEUTERON WERE TAKEN FROM
        THE WORKS OF PEREY/11/, LEMOS/12/ AND LOHR AND HAEVERLI
        /13/, RESPECTIVELY.  THE CALCULATED (N,P) CROSS SECTION
        WAS MULTIPLIED BY 0.3333 IN ORDER TO FIT TO THE
        EXPERIMENTAL DATA /14,15,16/ AROUND 14 MEV.

  MT=102    RADIATIVE CAPTURE CROSS SECTION
        1.0E-5 EV TO 200 KEV: RESONANCE PARAMETERS GIVEN BETWEEN
                              30 KEV AND 200 KEV.
        200 KEV TO 3 MEV: CALCULATED WITH THE CASTHY CODE/17/.
                          THE CALCULATION WAS NORMALIZED TO
                          4 MB AT 100 KEV.
        3 MEV TO 20 MEV:  BASED ON THE MEASUREMENTS./18,19,20/.

  MT=251    MU-BAR
        CALCULATED FROM FILE-4.

MF=4          ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,51-62
        CALCULATED WITH CASTHY FOR EQUILIBRIUM PROCESS.
        THE COMPONENTS OF THE DIRECT PROCESS WERE ADDED TO
        THE LEVELS OF MT=51,52,58 BY USING THE DWUCK CODE /21/.
  MT=16, 17, 22, 28
        ASSUMED TO BE ISOTROPIC IN THE LABORATORY SYSTEM.
  MT=91
        THE KALBACH-MANN SYSTEMATICS/22/ ADOPTED AT 14 MEV.

MF=5          ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16, 17, 22, 28, 91
        CALCULATED WITH SINCROS.

MF=12         PHOTON PRODUCTION MULTIPLICITIES
  MT=3 (ABOVE 200 KEV)
        CALCULATED WITH SINCROS.
  MT=102 (BELOW 200 KEV)
        CALCULATED FROM ENERGY BALANCE.

MF=14         PHOTON ANGULAR DISTRIBUTIONS
  MT=3,102
        ASSUMED TO BE ISOTROPIC.

MF=15         PHOTON ENERGY DISTRIBUTIONS
  MT=3,102
        CALCULATED WITH SINCROS.
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MAT number = 8825

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 88-RA-223 TIT          EVAL-AUG88 N.TAKAGI
                        DIST-SEP89
HISTORY
88-08 NEW EVALUATION WAS MADE BY N. TAKAGI (TOKYO INSTITUTE OF
      TECHNOLOGY, TIT)

MF=1  GENERAL INFORMATION
  MT=451   COMMENT AND DICTIONARY
  MT=452   NUMBER OF NEUTRONS PER FISSION
            EVALUATED WITH SEMI EMPIRICAL FORMULA OF HOWERTON/1/.

MF=2  RESONANCE PARAMETERS
  MT=151   RESONANCE PARAMETERS
    NO RESONANCE PARAMETERS WERE GIVEN.

  2200-M/S CROSS SECTIONS AND RESONANCE INTEGRALS
                        2200 M/S VALUE       RES. INT.
        TOTAL             143.10    B            -
        ELASTIC            12.40    B            -
        FISSION             0.70    B         1.06  B
        CAPTURE           130.00    B         435   B

MF=3  NEUTRON CROSS SECTIONS
  MT=1  TOTAL CROSS SECTION
        BELOW  4 EV, CALCULATED AS SUM OF MT'S = 2, 18 AND 102.
        ABOVE  4 EV, OPTICAL MODEL CALCULATION WAS MADE WITH
        CASTHY/2/.  THE POTENTIAL PARAMETERS/3/ USED ARE AS
        FOLLOWS,
           V = 41.0 - 0.05*EN                          (MEV)
           WS= 6.4 - 0.15*SQRT(EN)                     (MEV)
           WV= 0              , VSO = 7.0              (MEV)
           R = RSO = 1.31     , RS = 1.38               (FM)
           A = ASO = 0.47     , B  = 0.47               (FM)

  MT=2  ELASTIC SCATTERING CROSS SECTION
        BELOW 4 EV, THE CONSTANT CROSS SECTION OF 12.4 BARNS WAS
        ASSUMED, WHICH WAS THE SHAPE ELASTIC SCATTERING CROSS
        SECTION CALCULATED WITH OPTICAL MODEL.  ABOVE THIS ENERGY,
        OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT=4,51-52,91  INELASTIC SCATTERING CROSS SECTIONS.
        OPTICAL AND STATISTICAL MODEL CALCULATION WAS MADE WITH
        CASTHY/2/.  THE LEVEL SCHEME WAS TAKEN FROM REF. 4.
                   NO         ENERGY(KEV)   SPIN-PARITY
                  G.S.            0.0          1/2 +
                    1            50.19         3/2 -
                    2            61.53         5/2 +
                    3            79.77         3/2 -
                    4           123.91         5/2 -
                    5           130.27         7/2 +
                    6           174.72         9/2 +
                    7           174.78         7/2 -
                    8           247.47         9/2 -
                    9           280.31         3/2 +
                   10           286.16         3/2 +
                   11           329.95         3/2 -
                   12           334.52         3/2 +
                   13           342.50         3/2 +
                   14           342.92         5/2 +
        LEVELS ABOVE 369.43 KEV WERE ASSUMED TO BE OVERLAPPING.
        THE LEVEL DENSITY PARAMETERS WERE TAKEN FROM REF. 5.

  MT=16,17,37  (N,2N), (N,3N) AND (N,4N) REACTION CROSS SECTIONS
        CALCULATED WITH EVAPORATION MODEL.

  MT=18  FISSION CROSS SECTION
        MEASURED THERMAL CROSS SECTION OF 0.7 BARN WAS TAKEN FROM
        REF. 6 , AND 1/V FORM WAS ASSUMED BELOW 4 EV.  ABOVE THIS
        ENERGY, THE CONSTANT CROSS SECTION WAS ADOPTED.

  MT=102  CAPTURE CROSS SECTION
        MEASURED THERMAL CROSS SECTION OF 130 BARNS WAS TAKEN FROM
        REF. 6 , AND 1/V FORM WAS ASSUMED BELOW 4 EV.  ABOVE 4 EV,
        CALCULATED WITH CASTHY. THE GAMMA-RAY STRENGTH FUNCTION
        WAS ESTIMATED FROM GAMMA-GAMMA = 0.040 EV AND LEVEL
        SPACING = 8 EV.

  MT=251  MU-L
        CALCULATED WITH CASTHY.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
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  MT=2,51-64,91        CALCULATED WITH OPTICAL MODEL.
  MT=16,17,18,37       ISOTROPIC IN THE LAB SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,37,91       EVAPORATION SPECTRA
         OBTAINED FROM LEVEL DENSITY PARAMETERS.

  MT=18                MAXWELLIAN FISSION SPECTRUM.
        TEMPERATURE WAS ESTIMATED FROM Z**2/A DEPENDENCE/7/.
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MAT number = 8828

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 88-RA-224 TIT          EVAL-AUG88 N.TAKAGI
                        DIST-SEP89
HISTORY
88-08 NEW EVALUATION WAS MADE BY N. TAKAGI (TOKYO INSTITUTE OF
      TECHNOLOGY, TIT)

MF=1  GENERAL INFORMATION
  MT=451   COMMENT AND DICTIONARY

MF=2  RESONANCE PARAMETERS
  MT=151   RESONANCE PARAMETERS
    NO RESONANCE PARAMETERS WERE GIVEN.

  2200-M/S CROSS SECTIONS AND RESONANCE INTEGRALS
                        2200 M/S VALUE       RES. INT.
        TOTAL             24.50  B              -
        ELASTIC           12.50  B              -
        CAPTURE           12.00  B           29.0  B

MF=3  NEUTRON CROSS SECTIONS
  MT=1  TOTAL CROSS SECTION
        BELOW 45 EV, CALCULATED AS SUM OF MT'S = 2 AND 102.
        ABOVE 45 EV, OPTICAL MODEL CALCULATION WAS MADE WITH
        CASTHY/2/.  THE POTENTIAL PARAMETERS/3/ USED ARE AS
        FOLLOWS.
           V = 41.0 - 0.05*EN                          (MEV)
           WS= 6.4 - 0.15*SQRT(EN)                     (MEV)
           WV= 0               , VSO = 7.0             (MEV)
           R = RSO = 1.31      , RS = 1.38              (FM)
           A = ASO = 0.47      , B  = 0.47              (FM)

  MT=2  ELASTIC SCATTERING CROSS SECTION
        BELOW 45 EV, THE CONSTANT CROSS SECTION OF 12.5 BARNS WAS
        ASSUMED, WHICH WAS THE SHAPE ELASTIC SCATTERING CROSS
        SECTION CALCULATED WITH OPTICAL MODEL. ABOVE THIS ENERGY,
        OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT=4,51-61,91  INELASTIC SCATTERING CROSS SECTIONS.
        OPTICAL AND STATISTICAL MODEL CALCULATION WAS MADE WITH
        CASTHY/2/.  THE LEVEL SCHEME WAS TAKEN FROM REF. 4.
                   NO         ENERGY(KEV)   SPIN-PARITY
                  G.S.            0.0          2 +
                    1            84.37         2 +
                    2           215.99         1 -
                    3           250.78         4 +
                    4           290.36         3 -
                    5           433.08         5 -
                    6           479.30         6 +
                    7           916.33         0 +
                    8           965.51         2 +
                    9           992.65         2 +
                   10          1052.95         1 -
                   11          1089.98         2 -
        LEVELS ABOVE 1187 KEV WERE ASSUMED TO BE OVERLAPPING.
        THE LEVEL DENSITY PARAMETERS WERE TAKEN FROM REF. 5.

  MT=16,17,37  (N,2N), (N,3N) AND (N,4N) REACTION CROSS SECTIONS
        CALCULATED WITH EVAPORATION MODEL.

  MT=102  CAPTURE CROSS SECTION
        MEASURED THERMAL CROSS SECTION OF 12 BARNS WAS TAKEN
        FROM REF. 6 , AND 1/V FORM WAS ASSUMED BELOW 45 EV.
        ABOVE 45 EV, CROSS SECTION WAS CALCULATED WITH CASTHY.
        THE GAMMA-RAY STRENGTH FUNCTION WAS ESTIMATED FROM
        GAMMA-GAMMA = 0.040 EV AND LEVEL SPACING = 90 EV.

  MT=251  MU-L
        CALCULATED WITH CASTHY.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,51-61,91         CALCULATED WITH OPTICAL MODEL.
  MT=16,17,37           ISOTROPIC IN THE LAB SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,37,91        EVAPORATION SPECTRA
          OBTAINED FROM LEVEL DENSITY PARAMETERS.

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MAT number = 8831
 88-RA-225 TIT          EVAL-AUG88 N.TAKAGI
                        DIST-SEP89
HISTORY
88-08 NEW EVALUATION WAS MADE BY N. TAKAGI (TOKYO INSTITUTE OF
      TECHNOLOGY, TIT)

MF=1  GENERAL INFORMATION
  MT=451   COMMENT AND DICTIONARY

MF=2  RESONANCE PARAMETERS
    NO RESONANCE PARAMETERS WERE GIVEN.

  2200-M/S CROSS SECTIONS AND RESONANCE INTEGRALS
                        2200 M/S VALUE       RES. INT.
        TOTAL            112.40    B              -
        ELASTIC           12.40    B              -
        CAPTURE          100.00    B            593 B

MF=3  NEUTRON CROSS SECTIONS
  MT=1  TOTAL CROSS SECTION
        BELOW  2.5 EV, CALCULATED AS SUM OF MT'S = 2 AND 102.
        ABOVE  2.5 EV, OPTICAL MODEL CALCULATION WAS MADE WITH
        CASTHY/2/.  THE POTENTIAL PARAMETERS/3/ USED ARE AS
        FOLLOWS,
           V = 41.0 - 0.05*EN                           (MEV)
           WS= 6.4 - 0.15*SQRT(EN)                      (MEV)
           WV= 0             , VSO = 7.0                (MEV)
           R = RSO = 1.31    , RS = 1.38                 (FM)
           A = ASO = 0.47    , B  = 0.47                 (FM)

  MT=2  ELASTIC SCATTERING CROSS SECTION
        BELOW 2.5 EV, THE CONSTANT CROSS SECTION OF 12.4 BARNS WAS
        ASSUMED, WHICH WAS THE SHAPE ELASTIC SCATTERING CROSS
        SECTION CALCULATED WITH OPTICAL MODEL.  ABOVE THIS ENERGY,
        OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT=4,51-56,91  INELASTIC SCATTERING CROSS SECTIONS.
        OPTICAL AND STATISTICAL MODEL CALCULATION WAS MADE WITH
        CASTHY/2/.  THE LEVEL SCHEME WAS TAKEN FROM REF. 4.
                   NO         ENERGY(KEV)   SPIN-PARITY
                  G.S.             0.0         3/2 +
                    1             25.39        5/2 +
                    2             42.75        3/2 +
                    3            100.60        9/2 +
                    4            111.60        7/2 +
                    5            149.90        3/2 +
                    6            179.80        3/2 +
        LEVELS ABOVE 203 KEV WERE ASSUMED TO BE OVERLAPPING.
        THE LEVEL DENSITY PARAMETERS WERE TAKEN FROM REF. 5.

  MT=16,17,37  (N,2N), (N,3N) AND (N,4N) REACTION CROSS SECTIONS
        CALCULATED WITH EVAPORATION MODEL.

  MT=102  CAPTURE CROSS SECTION
        ASSUMED TO BE 100 BARNS AT 0.0253 EV, AND IN 1/V FORM
        BELOW 2.5 EV.  ABOVE 2.5 EV, CALCULATED WITH CASTHY. THE
        GAMMA-RAY STRENGTH FUNCTION WAS ESTIMATED FROM GAMMA-GAMMA
        = 0.040 EV AND LEVEL SPACING = 5 EV.

  MT=251  MU-L
        CALCULATED WITH CASTHY.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,51-56,91         CALCULATED WITH OPTICAL MODEL.
  MT=16,17,37           ISOTROPIC IN THE LAB SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,37,91        EVAPORATION SPECTRA
         OBTAINED FROM LEVEL DENSITY PARAMETERS.

REFERENCES
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```
 1) HOWERTON R.J.: NUCL. SCI. ENG., 62, 438 (1977).
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 3) OHSAWA T., OHTA M.: J. NUCL. SCI. TECHNOL., 18, 408 (1981).
 4) TOTH K.S.: NUCL. DATA SHEETS, 27, 701 (1979).
 5) GILBERT A., CAMERON A.G.W.: CAN. J. PHYS., 43, 1446 (1965).
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MAT number = 8834

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 88-RA-226 TIT         EVAL-AUG88 N.TAKAGI
                       DIST-SEP89 REV2-NOV93
HISTORY
88-08 NEW EVALUATION WAS MADE BY N. TAKAGI (TOKYO INSTITUTE OF
      TECHNOLOGY, TIT)/1/
93-11 JENDL-3.2.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (3,1), (3,18)        BELOW 6 MEV.
     ***********************************************************


MF=1  GENERAL INFORMATION
  MT=451   COMMENT AND DICTIONARY
  MT=452   NUMBER OF NEUTRONS PER FISSION
            EVALUATED WITH SEMI EMPIRICAL FORMULA OF HOWERTON/2/.

MF=2  RESONANCE PARAMETERS
  MT=151   RESOLVED RESONANCE PARAMETERS : 1.0E-5 EV TO 1000 EV.
           MULTI-LEVEL BREIT-WIGNER FORMULA WAS ADOPTED.
           PARAMETERS WERE TAKEN FROM THOSE BY IVANOV/3/.
           NO FISSION WIDTH WAS GIVEN FOR ALL THE RESONANCES.
                AVERAGE GAM-G = 0.0258 EV
                EFFECTIVE SCATTERING RADIUS = 9.60 FM

  2200-M/S CROSS SECTIONS AND RESONANCE INTEGRALS
                       2200 M/S VALUE       RES. INT.
        TOTAL            22.58    B             -
        ELASTIC           9.80    B             -
        FISSION           7.0E-6  B           0.0119 B
        CAPTURE          12.78    B           285.6  B

MF=3  NEUTRON CROSS SECTIONS
  MT=1  TOTAL CROSS SECTION
        BELOW 1 KEV, CROSS SECTION WAS REPRESENTED WITH RESONANCE
        PARAMETERS. ABOVE 1 KEV, OPTICAL MODEL CALCULATION WAS
        MADE WITH CASTHY/4/.  THE POTENTIAL PARAMETERS/5/ USED
        ARE AS FOLLOWS.
           V = 41.0 - 0.05*EN                         (MEV)
           WS= 6.4 - 0.15*SQRT(EN)                    (MEV)
           WV= 0               , VSO = 7.0            (MEV)
           R = RSO = 1.31      , RS = 1.38             (FM)
           A = ASO = 0.47      , B  = 0.47             (FM)

  MT=2  ELASTIC SCATTERING CROSS SECTION
        BELOW 1 KEV, CROSS SECTION WAS REPRESENTED WITH RESONANCE
        PARAMETERS. ABOVE 1 KEV, OPTICAL MODEL CALCULATION WAS
        ADOPTED.

  MT=4,51-66,91  INELASTIC SCATTERING CROSS SECTIONS.
        OPTICAL AND STATISTICAL MODEL CALCULATION WAS MADE WITH
        CASTHY/4/.  THE LEVEL SCHEME WAS TAKEN FROM REF./6/
                   NO          ENERGY(KEV)   SPIN-PARITY
                  G.S.             0.0          0 +
                    1             67.67         2 +
                    2            211.54         4 +
                    3            253.73         1 -
                    4            321.54         3 -
                    5            416.60         6 +
                    6            446.20         5 -
                    7            626.90         7 -
                    8            650.00         0 +
                    9            669.40         8 +
                   10            824.60         0 +
                   11            857.90         9 -
                   12            873.70         2 +
                   13            960.00        10 +
                   14           1048.60         1 -
                   15           1070.50         2 -
                   16           1134.00        11 -
        LEVELS ABOVE 1446 KEV WERE ASSUMED TO BE OVERLAPPING.
        THE LEVEL DENSITY PARAMETERS WERE TAKEN FROM REF./7/

  MT=16,17,37  (N,2N), (N,3N) AND (N,4N) REACTION CROSS SECTIONS
        CALCULATED WITH EVAPORATION MODEL.

  MT=18  FISSION CROSS SECTION
        MEASURED THERMAL CROSS SECTION OF 7 MICRO-BARN WAS TAKEN
        FROM REF./8/, AND 1/V FORM WAS ASSUMED BELOW 10 EV.  FOR
        ENERGY REGION ABOVE 1 MEV, THE EVALUATION WAS BASED ON
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        EXPERIMENTAL DATA /9,10,11,12/, AND BETWEEN 15 EV AND
        FISSION THRESHOLD, CROSS SECTION WAS ASSUMED TO BE THE
        SAME AS THE VALUE AT 15 EV.

  MT=102  CAPTURE CROSS SECTION
        BELOW 1 KEV, CROSS SECTION WAS REPRESENTED WITH RESONANCE
        PARAMETERS.  ABOVE 1 KEV, IT WAS CALCULATED WITH CASTHY.
        THE GAMMA-RAY STRENGTH FUNCTION WAS ESTIMATED FROM
        GAMMA-GAMMA = 0.040 EV AND LEVEL SPACING = 30.3 EV.

  MT=251  MU-L
        CALCULATED WITH CASTHY.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,51-66,91        CALCULATED WITH OPTICAL MODEL.
  MT=16,17,18,37       ISOTROPIC IN THE LAB SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,37,91       EVAPORATION SPECTRA
         OBTAINED FROM LEVEL DENSITY PARAMETERS.

  MT=18                MAXWELLIAN FISSION SPECTRUM.
        TEMPERATURE WAS ESTIMATED FROM Z**2/A DEPENDENCE/13/.
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 1) TAKAGI N. ET AL.: J. NUCL. SCI. TECHNOL., 27, 853 (1990).
 2) HOWERTON R.J.: NUCL. SCI. ENG., 62, 438 (1977).
 3) IVANOV R.N. ET AL.: AT. ENERG., 42, 505 (1977).
 4) IGARASI S. AND FUKAFORI T.: JAERI 1321 (1991).
 5) OHSAWA T., OHTA M.: J. NUCL. SCI. TECHNOL., 18, 408 (1981).
 6) ELLIS-AKOVALI Y.A.: NUCL. DATA SHEETS, 50, 229 (1987).
 7) GILBERT A., CAMERON A.G.W.: CAN. J. PHYS., 43, 1446 (1965).
 8) NAKAHARA H. ET AL.: J. INORG. NUCL. CHEM., 38, 203 (1976).
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10) BABENKO JU.A. ET AL.: YAD. FIZ., 7, 269 (1968).
11) ZHAGROV E.A. ET AL.: NUCL. PHYS., A213, 436 (1973).
12) NEMILOV YU.A. ET AL.: YAD. FIZ., 37, 819 (1983).
13) SMITH A.B. ET AL.: ANL/NDM-50 (1979).
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MAT number = 8925

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 89-AC-225 TIT          EVAL-AUG88 N.TAKAGI
                        DIST-SEP89
HISTORY
88-08 NEW EVALUATION WAS MADE BY N. TAKAGI (TOKYO INSTITUTE OF
      TECHNOLOGY, TIT)

MF=1  GENERAL INFORMATION
  MT=451   COMMENT AND DICTIONARY

MF=2  RESONANCE PARAMETERS
  MT=151   RESONANCE PARAMETERS
    NO RESONANCE PARAMETERS WERE GIVEN.

  2200-M/S CROSS SECTIONS AND RESONANCE INTEGRALS
                      2200 M/S VALUE        RES. INT.
        TOTAL          1012.40   B             -
        ELASTIC          12.40   B             -
        CAPTURE        1000.00   B           1590  B

MF=3  NEUTRON CROSS SECTIONS
  MT=1  TOTAL CROSS SECTION
        BELOW  0.6 EV, CALCULATED AS SUM OF MT'S = 2 AND 102.
        ABOVE  0.6 EV, OPTICAL MODEL CALCULATION WAS MADE WITH
        CASTHY/2/.  THE POTENTIAL PARAMETERS/3/ USED ARE AS
        FOLLOWS.
           V = 41.0 - 0.05*EN                           (MEV)
           WS= 6.4 - 0.15*SQRT(EN)                      (MEV)
           WV= 0              , VSO = 7.0               (MEV)
           R = RSO = 1.31     , RS = 1.38                (FM)
           A = ASO = 0.47     , B  = 0.47                (FM)

  MT=2  ELASTIC SCATTERING CROSS SECTION
        BELOW 0.6 EV, THE CONSTANT CROSS SECTION OF 12.4 BARNS WAS
        ASSUMED, WHICH WAS THE SHAPE ELASTIC SCATTERING CROSS
        SECTION CALCULATED WITH OPTICAL MODEL. ABOVE THIS ENERGY,
        OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT=4,51-52,91  INELASTIC SCATTERING CROSS SECTIONS.
        OPTICAL AND STATISTICAL MODEL CALCULATION WAS MADE WITH
        CASTHY/2/.  THE LEVEL SCHEME WAS TAKEN FROM REF. 4.
                   NO          ENERGY(KEV)   SPIN-PARITY
                  G.S.             0.0          3/2 +
                    1             40.0          3/2 +
        LEVELS ABOVE 64 KEV WERE ASSUMED TO BE OVERLAPPING.
        THE LEVEL DENSITY PARAMETERS WERE TAKEN FROM REF. 5.

  MT=16,17,37  (N,2N), (N,3N) AND (N,4N) REACTION CROSS SECTIONS
        CALCULATED WITH EVAPORATION MODEL.

  MT=102  CAPTURE CROSS SECTION
        ASSUMED TO BE 1000 BARNS AT 0.0253 EV BY THE CORRELATION
        OF THERMAL CROSS SECTION WITH NUMBER OF EXCESS NEUTRONS.
        BELOW 0.6 EV, THE 1/V FORM WAS ASSUMED.  ABOVE THIS
        ENERGY, CALCULATED WITH CASTHY. THE GAMMA-RAY STRENGTH
        FUNCTION WAS ESTIMATED FROM GAMMA-GAMMA = 0.040 EV AND
        LEVEL SPACING = 1.2 EV.

  MT=251  MU-L
        CALCULATED WITH CASTHY.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,51-52,91         CALCULATED WITH OPTICAL MODEL.
  MT=16,17,37           ISOTROPIC IN THE LAB SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,37,91        EVAPORATION SPECTRA
         OBTAINED FROM LEVEL DENSITY PARAMETERS.

REFERENCES
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 1) HOWERTON R.J.: NUCL. SCI. ENG., 62, 438 (1977).
 2) IGARASI S.: J.NUCL.SCI.TECHNOL.,12,67 (1975).
 3) OHSAWA T., OHTA M.: J. NUCL. SCI. TECHNOL., 18, 408 (1981).
 4) TOTH K.S.: NUCL. DATA SHEETS, 27, 701 (1979).
 5) GILBERT A., CAMERON A.G.W.: CAN. J. PHYS., 43, 1446 (1965).
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MAT number = 8928
 89-AC-226 TIT          EVAL-AUG88 N.TAKAGI
                        DIST-SEP89
HISTORY
88-08 NEW EVALUATION WAS MADE BY N. TAKAGI (TOKYO INSTITUTE OF
      TECHNOLOGY, TIT)

MF=1  GENERAL INFORMATION
  MT=451   COMMENT AND DICTIONARY

MF=2  RESONANCE PARAMETERS
  MT=151   RESONANCE PARAMETERS
    NO RESONANCE PARAMETERS WERE GIVEN.

  2200-M/S CROSS SECTIONS AND RESONANCE INTEGRALS
                        2200 M/S VALUE       RES. INT.
        TOTAL             112.40   B             -
        ELASTIC            12.40   B             -
        CAPTURE           100.00   B           1680  B

MF=3  NEUTRON CROSS SECTIONS
  MT=1  TOTAL CROSS SECTION
        BELOW  0.4 EV, CALCULATED AS SUM OF MT'S = 2 AND 102.
        ABOVE  0.4 EV, OPTICAL MODEL CALCULATION WAS MADE WITH
        CASTHY/2/.  THE POTENTIAL PARAMETERS/3/ USED ARE AS
        FOLLOWS,
           V = 41.0 - 0.05*EN                            (MEV)
           WS= 6.4 - 0.15*SQRT(EN)                       (MEV)
           WV= 0              , VSO = 7.0                (MEV)
           R = RSO = 1.31     , RS = 1.38                 (FM)
           A = ASO = 0.47     , B  = 0.47                 (FM)

  MT=2  ELASTIC SCATTERING CROSS SECTION
        BELOW 0.4 EV, THE CONSTANT CROSS SECTION OF 12.4 BARNS WAS
        ASSUMED, WHICH WAS THE SHAPE ELASTIC SCATTERING CROSS
        SECTION CALCULATED WITH OPTICAL MODEL.  ABOVE THIS ENERGY,
        OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT=4,51-52,91  INELASTIC SCATTERING CROSS SECTIONS.
        CALCULATED WITH OPTICAL AND STATISTICAL MODELS BY MEANS OF
        CASTHY/2/. NO EXCITED LEVELS WERE TAKEN INTO CALCULATION,
        BECAUSE SPIN OF ALL LEVELS WERE UNKNOWN/4/.
                  NO          ENERGY(KEV)   SPIN-PARITY
                 G.S.             0.0           1 +
        LEVELS ABOVE 290 KEV WERE ASSUMED TO BE OVERLAPPING.
        THE LEVEL DENSITY PARAMETERS WERE TAKEN FROM REF. 5.

  MT=16,17,37  (N,2N), (N,3N) AND (N,4N) REACTION CROSS SECTIONS
        CALCULATED WITH EVAPORATION MODEL.

  MT=102  CAPTURE CROSS SECTION
        ASSUMED TO BE 100 BARNS AT 0.0253 EV, AND IN 1/V FORM
        BELOW 0.4 EV.  ABOVE 0.4 EV, CALCULATED WITH CASTHY.
        THE GAMMA-RAY STRENGTH FUNCTION WAS ESTIMATED FROM
        GAMMA-GAMMA = 0.040 EV AND LEVEL SPACING = 0.8 EV.

  MT=251  MU-L
        CALCULATED WITH CASTHY.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,91               CALCULATED WITH OPTICAL MODEL.
  MT=16,17,37           ISOTROPIC IN THE LAB SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,37,91        EVAPORATION SPECTRA
          OBTAINED FROM LEVEL DENSITY PARAMETERS.
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 1) HOWERTON R.J.: NUCL. SCI. ENG., 62, 438 (1977).
 2) IGARASI S.: J.NUCL.SCI.TECHNOL.,12,67 (1975).
 3) OHSAWA T., OHTA M.: J. NUCL. SCI. TECHNOL., 18, 408 (1981).
 4) ELLIS-AKOVALI Y.A.: NUC;. DATA SHEETS, 50, 229 (1987).
 5) GILBERT A., CAMERON A.G.W.: CAN. J. PHYS., 43, 1446 (1965).
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MAT number = 8931
 89-AC-227 TIT         EVAL-AUG88 N.TAKAGI
                       DIST-SEP89
HISTORY
88-08 NEW EVALUATION WAS MADE BY N. TAKAGI (TOKYO INSTITUTE OF
      TECHNOLOGY, TIT)

MF=1  GENERAL INFORMATION
  MT=451   COMMENT AND DICTIONARY
  MT=452   NUMBER OF NEUTRONS PER FISSION
            EVALUATED WITH SEMI EMPIRICAL FORMULA OF HOWERTON/1/.

MF=2  RESONANCE PARAMETERS
  MT=151   RESONANCE PARAMETERS
    NO RESONANCE PARAMETERS WERE GIVEN.

  2200-M/S CROSS SECTIONS AND RESONANCE INTEGRALS
                       2200 M/S VALUE       RES. INT.
        TOTAL            902.40    B            -
        ELASTIC           12.40    B            -
        FISSION            0.00029 B          0.138 B
        CAPTURE          890.00    B          1650  B

MF=3  NEUTRON CROSS SECTIONS
  MT=1  TOTAL CROSS SECTION
        BELOW  36 EV, CALCULATED AS SUM OF MT'S = 2, 18 AND 102.
        ABOVE  36 EV, OPTICAL MODEL CALCULATION WAS MADE WITH
        CASTHY/2/.  THE POTENTIAL PARAMETERS/3/ USED ARE AS
        FOLLOWS,
           V = 41.0 - 0.05*EN                           (MEV)
           WS= 6.4 - 0.15*SQRT(EN)                      (MEV)
           WV= 0              , VSO = 7.0               (MEV)
           R = RSO = 1.31     , RS = 1.38                (FM)
           A = ASO = 0.47     , B  = 0.47                (FM)

  MT=2  ELASTIC SCATTERING CROSS SECTION
        BELOW 36 EV, THE CONSTANT CROSS SECTION OF 12.4 BARNS WAS
        ASSUMED, WHICH WAS THE SHAPE ELASTIC SCATTERING CROSS
        SECTION CALCULATED WITH OPTICAL MODEL.  ABOVE THIS ENERGY,
        OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT=4,51-59,91  INELASTIC SCATTERING CROSS SECTIONS.
        OPTICAL AND STATISTICAL MODEL CALCULATION WAS MADE WITH
        CASTHY/2/.  THE LEVEL SCHEME WAS TAKEN FROM REF. 4.
                   NO         ENERGY(KEV)   SPIN-PARITY
                  G.S.            0.0          3/2 -
                    1            27.36         3/2 +
                    2            29.95         5/2 -
                    3            46.37         5/2 +
                    4            74.14         7/2 -
                    5            84.56         7/2 +
                    6           110.00         9/2 +
                    7           126.85         9/2 -
                    8           187.36        11/2 -
                    9           210.92        13/2 +
        LEVELS ABOVE 273 KEV WERE ASSUMED TO BE OVERLAPPING.
        THE LEVEL DENSITY PARAMETERS WERE TAKEN FROM REF. 5.

  MT=16,17,37  (N,2N), (N,3N) AND (N,4N) REACTION CROSS SECTIONS
        CALCULATED WITH EVAPORATION MODEL.

  MT=18  FISSION CROSS SECTION
        MEASURED THERMAL CROSS SECTION OF 0.29 MILLI-BARN WAS
        TAKEN FROM REF. 6 , AND 1/V FORM WAS ASSUMED BELOW 36 EV.
        ABOVE FISSION THRESHOLD ENERGY, EXPERIMENTAL DATA/7/ WERE
        ADOPTED, AND IN THE ENERGY RANGE BETWEEN 36 EV AND FISSION
        THRESHOLD, CROSS SECTION WAS ASSUMED TO BE CONSTANT WITH
        THE VALUE AT 36 EV.

  MT=102  CAPTURE CROSS SECTION
        MEASURED THERMAL CROSS SECTION OF 890 BARNS WAS TAKEN FROM
        REF. 6 , AND 1/V FORM WAS ASSUMED BELOW 36 EV.  THE CROSS
        SECTION NEAR 36 EV WAS ADJUSTED SO AS TO REPRODUCE THE
        MEASURED RESONANCE INTEGRAL/6/.  ABOVE 0.45 EV, CROSS
        SECTION WAS CALCULATED WITH CASTHY.  THE GAMMA-RAY
        STRENGTH FUNCTION WAS ESTIMATED FROM GAMMA-GAMMA = 0.040
        EV AND LEVEL SPACING = 72 EV.

  MT=251  MU-L
        CALCULATED WITH CASTHY.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
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  MT=2,51-59,91         CALCULATED WITH OPTICAL MODEL.
  MT=16,17,18,37        ISOTROPIC IN THE LAB SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,37,91        EVAPORATION SPECTRA
         OBTAINED FROM LEVEL DENSITY PARAMETERS.

  MT=18                 MAXWELLIAN FISSION SPECTRUM.
        TEMPERATURE WAS ESTIMATED FROM Z**2/A DEPENDENCE/8/.
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REFERENCES

1) HOWERTON R.J.: NUCL. SCI. ENG., 62, 438 (1977).
2) IGARASI S.: J.NUCL.SCI.TECHNOL.,12,67 (1975).
3) OHSAWA T., OHTA M.: J. NUCL. SCI. TECHNOL., 18, 408 (1981).
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5) GILBERT A., CAMERON A.G.W.: CAN. J. PHYS., 43, 1446 (1965).
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MAT number = 9025

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 90-TH-227 TIT          EVAL-AUG88 N.TAKAGI
                        DIST-SEP89 REV2-JUN94
HISTORY
88-08 NEW EVALUATION WAS MADE BY N. TAKAGI (TOKYO INSTITUTE OF
      TECHNOLOGY, TIT) /1/.
94-06 JENDL-3.2.
       NU-P, NU-D AND NU-TOTAL WERE MODIFIED.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (1,452), (1,455), (1,456)
     ***********************************************************


MF=1 GENERAL INFORMATION
  MT=451 COMMENT AND DICTIONARY
  MT=452 NUMBER OF NEUTRONS PER FISSION
       SUM OF NU-P NAD NU-D.
  MT=455 DELAYED NEUTRONS PER FISSION
       AVERAGE VALUES OF SYSTEMATICS BY TUTTLE/2/, BENEDETTI ET
       AL./3/ AND WALDO ET AL./4/  DECAY CONSTANTS WERE ADOPTED
       FROM THE EVALUATION BY BRADY AND ENGLAND/5/.
  MT=456 PROMPT NEUTRONS PER FISSION
       BASED ON SYSTEMATICS BY MANERO AND KONSHIN/6/, AND BY
       HOWERTON/7/.

MF=2  RESONANCE PARAMETERS
  MT=151   RESONANCE PARAMETERS
    NO RESONANCE PARAMETERS WERE GIVEN.

  2200-M/S CROSS SECTIONS AND RESONANCE INTEGRALS
                        2200 M/S VALUE       RES. INT.
        TOTAL            1749.40  B             -
        ELASTIC            12.40  B             -
        FISSION           202.00  B            210  B
        CAPTURE          1535.00  B           1420  B

MF=3  NEUTRON CROSS SECTIONS
  MT=1  TOTAL CROSS SECTION
        BELOW 0.45 EV, CALCULATED AS SUM OF MT'S = 2, 18 AND 102.
        ABOVE 0.45 EV, OPTICAL MODEL CALCULATION WAS MADE WITH
        CASTHY/8/.  THE POTENTIAL PARAMETERS/9/ USED ARE AS
        FOLLOWS.
           V = 41.0 - 0.05*EN                          (MEV)
           WS= 6.4 - 0.15*SQRT(EN)                     (MEV)
           WV= 0              , VSO = 7.0              (MEV)
           R = RSO = 1.31     , RS = 1.38               (FM)
           A = ASO = 0.47     , B  = 0.47               (FM)

  MT=2  ELASTIC SCATTERING CROSS SECTION
        BELOW 0.45 EV, THE CONSTANT CROSS SECTION OF 12.4 BARNS
        WAS ASSUMED, WHICH WAS THE SHAPE ELASTIC SCATTERING CROSS
        SECTION CALCULATED WITH OPTICAL MODEL.  ABOVE THIS ENERGY,
        OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT=4, 91  INELASTIC SCATTERING CROSS SECTIONS.
        OPTICAL AND STATISTICAL MODEL CALCULATION WAS MADE WITH
        CASTHY/8/.  NO EXCITED LEVELS WERE TAKEN INTO THE
        CALCULATION.
                   NO          ENERGY(KEV)   SPIN-PARITY
                  G.S.              0.0          3/2 +
        LEVELS ABOVE 9.3 KEV/10/ WERE ASSUMED TO BE OVERLAPPING.
        THE LEVEL DENSITY PARAMETERS WERE TAKEN FROM REF./11/.

  MT=16,17,37  (N,2N), (N,3N) AND (N,4N) REACTION CROSS SECTIONS
        CALCULATED WITH EVAPORATION MODEL.

  MT=18  FISSION CROSS SECTION
        MEASURED THERMAL CROSS SECTION OF 202 BARNS WAS TAKEN FROM
        REF./12/, AND 1/V FORM WAS ASSUMED BELOW 0.45 EV.  IN THE
        ENERGY RANGE ABOVE 0.45 EV, THE SHAPE WAS ASSUMED TO BE
        THE SAME AS TH-233 FISSION CROSS SECTION AND IT WAS
        NORMALIZED TO THE SYSTEMATICS OF BEHRENS AND HOWERTON/13/.

  MT=102  CAPTURE CROSS SECTION
        THE THERMAL CROSS SECTION OF 1535 BARNS WAS ESTIMATED FROM
        THE RATIO OF FISSION AND CAPTURE CROSS SECTIONS AT 1 EV
        AND THE MEASURED FISSION CROSS SECTION AT 0.0253 EV/12/,
        AND THE 1/V FORM WAS ASSUMED BELOW 0.45 EV.  ABOVE 0.45
        EV, CROSS SECTION WAS CALCULATED WITH CASTHY.  THE GAMMA-
        RAY STRENGTH FUNCTION WAS ESTIMATED FROM GAMMA-GAMMA =
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        0.040 EV AND LEVEL SPACING = 0.9 EV.

  MT=251  MU-L
        CALCULATED WITH CASTHY.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,91              CALCULATED WITH OPTICAL MODEL.
  MT=16,17,18,37       ISOTROPIC IN THE LAB SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,37,91       EVAPORATION SPECTRA
         OBTAINED FROM LEVEL DENSITY PARAMETERS.

  MT=18                MAXWELLIAN FISSION SPECTRUM.
        TEMPERATURE WAS ESTIMATED FROM Z**2/A DEPENDENCE/14/.
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 1) TAKAGI N. ET AL.: J. NUCL. SCI. TECHNOL., 27, 853 (1990).
 2) TUTTLE R.J.: INDC(NDS)-107/G+SPECIAL, P.29 (1979).
 3) BENEDETTI G. ET AL.: NUCL. SCI. ENG., 80, 379 (1982).
 4) WALDO R. ET AL.: PHYS. REV., C23, 1113 (1981).
 5) BRADY M.C. AND ENGLAND T.R.: NUCL. SCI. ENG., 103, 129(1989).
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MAT number = 9028

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 90-TH-228 KINKI U.   EVAL-JUN87 T.OHSAWA
                      DIST-SEP89 REV2-JUN94
HISTORY
81-04 EVALUATION FOR JENDL-2 WAS MADE BY T. OHSAWA* AND M. OHTA
      (KYUSHU UNIVERSITY).  DETAILS OF THE EVALUATION ARE
      DESCRIBED IN REF. /1/. (*PRESENT ADDRESS: KINKI UNIVERSITY)
83-11 FISSION SPECTRUM WAS ADDED.  RESONANCE FORMULA WAS CHANGED
      TO MLBW FORMULA.  THE TOTAL, (N,2N) AND (N,3N) CROSS SEC-
      TIONS WERE MODIFIED.
87-06 ALMOST OF JENDL-2 DATA WERE ADOPTED FOR JENDL-3.
      (MF3,MT17), (MF3,MT91) AND (MF3,MT102) WERE SLIGHTLY
      MODIFIED IN HIGH ENERGY REGION.
         COMPILATION WAS MADE BY T.NAKAGAWA (JAERI).
94-06 JENDL-3.2.
       NU-P, NU-D AND NU-TOTAL WERE MODIFIED.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (1,452), (1,455), (1,456)
     ***********************************************************


MF=1 GENERAL INFORMATION
  MT=451 COMMENT AND DICTIONARY
  MT=452 NUMBER OF NEUTRONS PER FISSION
      SUM OF NU-P NAD NU-D.
  MT=455 DELAYED NEUTRONS PER FISSION
      AVERAGE VALUES OF SYSTEMATICS BY TUTTLE/2/, BENEDETTI ET
      AL./3/ AND WALDO ET AL./4/  DECAY CONSTANTS WERE ASSUMED
      TO BE THE SAME AS THOSE OF TH-229 EVALUATED BY BRADY AND
      ENGLAND/5/.
  MT=456 PROMPT NEUTRONS PER FISSION
      BASED ON THE SEMI-EMPIRICAL FORMULA OF HOWERTON /6/.

MF=2  RESONANCE PARAMETERS
  MT=151  RESOLVED RESONANCES
      RESONANCE REGION IS BELOW 7.798 EV.  PARAMETERS WERE GIVEN
      FOR THE MLBW FORMULA.  ONLY TWO RESONANCES WERE OBSERVED BY
      SIMPSON ET AL./7/.  AN ADDITIONAL TERM WITH 1/V DEPENDENCE
      WAS ASSUMED TO REPRODUCE THE THERMAL CAPTURE CROSS SECTION.
      FISSION CROSS SECTION WAS ALSO ASSUMED TO HAVE 1/V BEHAVIOR.

      CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEG.(BARNS)
                         2200-M/S       RES. INTEG.
              ELASTIC      12.81           -
              CAPTURE     119.9          1170
              FISSION       0.300           1.02
              TOTAL       133.0             -

MF=3  NEUTRON CROSS SECTIONS
      BELOW 7.798 EV IS THE RESONANCE REGION.  BACKGROUND DATA
      WERE GIVEN.  THE CROSS SECTIONS WERE EVALUATED IN THE ENERGY
      REGION ABOVE 7.798 EV AS FOLLOWS.
  MT=1    TOTAL CROSS SECTION
      OPTICAL MODEL CALCULATION WITH THE FOLLOWING PARAMETERS:
         V  = 41.0 - 0.05*E        (MEV),
         WS = 6.4 + 0.15*SQRT(E)  (MEV),  -- DER. WOODS-SAXON --
         VSO= 7.0                  (MEV),
         R0 = RSO = 1.31           (FM),
         RS = 1.38                 (FM),
         A  = B  = ASO= 0.47       (FM).
      THESE PARAMETERS WERE TAKEN FROM THOSE FOR TH-232 /8/.
  MT=2    ELASTIC SCATTERING CROSS SECTION
      BASED ON STATISTICAL AND OPTICAL MODEL CALCULATIONS USING
      THE CODE CASTHY /9/.
  MT=4,51-62,91  INELASTIC SCATTERING CROSS SECTION
      STATISTICAL AND OPTICAL MODEL CALCULATIONS.

          LEVEL SCHEME OF TH-228 /10/.
             NO.      ENERGY(MEV)  SPIN-PARITY
              G.S.     0.0           0 +
              1        0.0576        2 +
              2        0.1869        4 +
              3        0.328         1 -
              4        0.3961        3 -
              5        0.5193        5 -
              6        0.8317        0 -
              7        0.8746        2 +
              8        0.9441        2 +
              9        0.952         1 -
             10        0.9688        2 +
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          11        1.016          3 -
          12        1.0224         3 +
        LEVELS ABOVE 1.025 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT=16,17  (N,2N) AND (N,3N) CROSS SECTIONS
      CALCULATED BY MEANS OF THE EVAPORATION MODEL OF SEGEV AND
      CANER /11/.
  MT=18   FISSION CROSS SECTION
      THE DATA OF VOROTNIKOV ET AL./12/ WERE ADOPTED UP TO 5 MEV.
      THE FISSION CROSS SECTION OF THE NEIGHBORING EVEN-EVEN
      ISOTOPE TH-230 NORMALIZED TO JOIN SMOOTHLY TO THE DATA OF
      VOROTNIKOV ET AL. WAS ADOPTED ABOVE 5 MEV.
  MT=102  CAPTURE CROSS SECTION
      STATISTICAL AND OPTICAL MODEL CALCULATIONS WITH GAMMA-RAY
      STRENGTH FUNCTION OF 0.00791.
  MT=251  MU-BAR
      CALCULATED WITH OPTICAL MODEL.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,51-62,91
      STATISTICAL AND OPTICAL MODEL CALCULATIONS.
  MT=16,17,18
      ASSUMED TO BE ISOTROPIC IN THE LABORATORY SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,91
      EVAPORATION SPECTRA
  MT=18
      FISSION SPECTRUM ESTIMATED FROM Z**2/A SYSTEMATICS BY SMITH
      ET AL./13/.
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MAT number = 9031
 90-TH-229 TIT        EVAL-AUG88 N.TAKAGI
                      DIST-SEP89 RREV2-JUN94
HISTORY
87-08 NEW EVALUATION WAS MADE BY N. TAKAGI (TOKYO INSTITUTE OF
      TECHNOLOGY, TIT) /1/.
94-06 JENDL-3.2.
       NU-P, NU-D AND NU-TOTAL WERE MODIFIED.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (1,452), (1,455), (1,456)
     ***********************************************************


MF=1 GENERAL INFORMATION
  MT=451 COMMENT AND DICTIONARY
  MT=452 NUMBER OF NEUTRONS PER FISSION
       SUM OF NU-P NAD NU-D.
  MT=455 DELAYED NEUTRONS PER FISSION
       AVERAGE VALUES OF SYSTEMATICS BY TUTTLE/2/, BENEDETTI ET
       AL./3/ AND WALDO ET AL./4/  DECAY CONSTANTS WERE ADOPTED
       FROM THE EVALUATION BY BRADY AND ENGLAND/5/.
  MT=456 PROMPT NEUTRONS PER FISSION
       BASED ON SYSTEMATICS BY MANERO AND KONSHIN/6/, AND BY
       HOWERTON/7/.

MF=2  RESONANCE PARAMETERS
  MT=151   RESOLVED RESONANCE PARAMETERS : 1.0E-5 EV TO 9.5 EV
    SINGLE-LEVEL BREIT WIGNER FORMULA WAS ADOPTED.  PARAMETERS
    WERE DETERMINED ON THE BASIS OF RECOMMENDATION OF MUGHABGHAB
    /8/.  FOR THE LEVELS WHOSE RADIATIVE WIDTH AND/OR FISSION
    WIDTH WERE UNKNOWN, AVERAGE GAMMA-G OF 0.043 EV WAS ASSUMED,
    FISSION WIDTHS WERE CALCULATED FROM (PEAK SIG)*(GAMMA-F).
    EFFECTIVE SCATTERING RADIUS WAS ASSUMED TO BE 10 FM.

  2200-M/S CROSS SECTIONS AND RESONANCE INTEGRALS
                      2200 M/S VALUE       RES. INT.
        TOTAL           104.09  B             -
        ELASTIC           9.928 B             -
        FISSION          30.81  B           444 B
        CAPTURE          63.34  B          1236 B

MF=3  NEUTRON CROSS SECTIONS
  MT=1  TOTAL CROSS SECTION
        ABOVE 9.5 EV, OPTICAL MODEL CALCULATION WAS MADE WITH
        CASTHY/9/.  THE POTENTIAL PARAMETERS/10/ USED ARE AS
        FOLLOWS,
           V = 41.0 - 0.05*EN                         (MEV)
           WS= 6.4 - 0.15*SQRT(EN)                    (MEV)
           WV= 0              , VSO = 7.0             (MEV)
           R = RSO = 1.31     , RS = 1.38              (FM)
           A = ASO = 0.47     , B  = 0.47              (FM)

  MT=2  ELASTIC SCATTERING CROSS SECTION
        OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT=4,51-54,91  INELASTIC SCATTERING CROSS SECTIONS.
        OPTICAL AND STATISTICAL MODE LCALCULATION WAS MADE WITH
        CASTHY/9/.  THE LEVEL SCHEME WAS TAKEN FROM REF./11/.
                   NO         ENERGY(KEV)   SPIN-PARITY
                  G.S.             0.0        5/2 +
                   1               0.1        3/2 +
                   2              20.0        3/2 +
                   3              29.2        5/2 +
                   4              42.5        7/2 +
        LEVELS ABOVE 67 KEV WERE ASSUMED TO BE OVERLAPPING.
        THE LEVEL DENSITY PARAMETERS WERE TAKEN FROM REF./12/.

  MT=16,17,37  (N,2N), (N,3N) AND (N,4N) REACTION CROSS SECTIONS
        CALCULATED WITH EVAPORATION MODEL.

  MT=18  FISSION CROSS SECTION
        ABOVE 9.5 EV, THE CROSS-SECTION SHAPE WAS ASSUMED TO BE
        THE SAME AS TH-233 FISSION CROSS SECTION AND IT WAS
        NORMALIZED BY THE FACTOR OBTAINED FROM SYSTEMATICS OF
        BEHRENS AND HOWERTON/13/.

  MT=102  CAPTURE CROSS SECTION
        CALCULATED WITH CASTHY. THE GAMMA-RAY STRENGTH FUNCTION
        WAS ESTIMATED FROM GAMMA-G = 0.040 EV AND LEVEL SPACING =
        0.53 EV.
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  MT=251  MU-L
        CALCULATED WITH CASTHY.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,51-54,91       CALCULATED WITH OPTICAL MODEL.
  MT=16,17,18,37      ISOTROPIC IN THE LAB SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,37         EVAPORATION SPECTRA WERE GIVEN
  MT=18               MAXWELLIAN FISSION SPECTRUM.  TEMPERATURE
                      WAS ESTIMATED FROM Z**2/A VALUES /14/.
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MAT number = 9034
 90-TH-230 KINKI U.   EVAL-JUL87 T.OHSAWA
                      DIST-SEP89 REV2-JUN94
HISTORY
81-04 EVALUATION FOR JENDL-2 WAS MADE BY T. OHSAWA AND M. OHTA
      (KYUSHU UNIVERSITY:  PRESENT ADDRESS OF OHSAWA IS KINKI
      UNIVERSITY).  DETAILS OF EVALUATION ARE DESCRIBED IN REF.
      /1/.
83-11 FISSION SPECTRUM WAS ADDED.  RESONANCE PARAMETERS, AND
      TOTAL, (N,2N) AND (N,3N) CROSS SECTIONS WERE MODIFIED.
87-07 EVALUATION FOR JENDL-2 WAS ADOPTED TO JENDL-3.  BUT RE-
      CALCULATION OF CROSS SECTIONS AND ANGULAR DISTRIBUTIONS
      WAS MADE WITH THE SAME OMP AND LEVEL DENSITY PARAMETERS.
          COMPILATION WAS MADE BY T.NAKAGAWA (JAERI).
94-06 JENDL-3.2.
       NU-P, NU-D AND NU-TOTAL WERE MODIFIED.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (1,452), (1,455), (1,456)
     ***********************************************************


MF=1 GENERAL INFORMATION
  MT=451 COMMENT AND DICTIONARY
  MT=452 NUMBER OF NEUTRONS PER FISSION
      SUM OF NU-P NAD NU-D.
  MT=455 DELAYED NEUTRONS PER FISSION
      AVERAGE VALUES OF SYSTEMATICS BY TUTTLE/2/, BENEDETTI ET
      AL./3/ AND WALDO ET AL./4/  DECAY CONSTANTS WERE ASSUMED
      TO BE THE SAME AS THOSE OF TH-229 EVALUATED BY BRADY AND
      ENGLAND/5/.
  MT=456 PROMPT NEUTRONS PER FISSION
      BASED ON THE SEMI-EMPIRICAL FORMULA OF HOWERTON /6/.

MF=2  RESONANCE PARAMETERS
  MT=151  RESOLVED RESONANCES
      RESONANCE REGION IS BELOW 564.26 EV.  THE MLBW FORMULA WAS
      SELECTED TO REPRODUCE RESONANCE CROSS SECTIONS.  A TOTAL
      NUMBER OF 28 RESONANCES UP TO 563 EV MEASURED BY KALEBIN ET
      AL. /7/ WERE ADOPTED IN THE PRESENT EVALUATION.
      A BACKGROUND TERM WITH 1/V DEPENDENCE WAS ADDED IN ORDER TO
      REPRODUCE THE THERMAL CAPTURE CROSS SECTION.

      CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEG.(BARNS)
                         2200-M/S       RES. INTEG.
              TOTAL        32.32           -
              ELASTIC       9.774          -
              FISSION       0.0             1.08
              CAPTURE      22.55         1040

MF=3  NEUTRON CROSS SECTIONS
       BELOW 564.26 EV IS THE RESONANCE REGION WHERE THE
       BACKGROUND CROSS SECTIONS ARE GIVEN.  ABOVE 564.26 EV, THE
       CROSS SECTIONS WERE EVALUATED AS FOLLOWS.

  MT=1    TOTAL CROSS SECTION
      OPTICAL MODEL CALCULATION WITH THE FOLLOWING PARAMETERS:
         V  = 41.0 - 0.05*E       (MEV),
         WS = 6.4 + 0.15*SQRT(E)  (MEV),  -- DER. WOODS-SAXON --
         VSO= 7.0                 (MEV),
         R0 = RSO = 1.31          (FM),
         RS = 1.38                (FM),
         A  = B  = ASO= 0.47      (FM).
      THESE PARAMETERS WERE TAKEN FROM THOSE FOR TH-232 /8/.
  MT=2    ELASTIC SCATTERING CROSS SECTION
      STATISTICAL AND OPTICAL MODEL CALCULATIONS USING THE CODE
      CASTHY /9/.
  MT=4,51-63,91  INELASTIC SCATTERING CROSS SECTION
      STATISTICAL AND OPTICAL MODEL CALCULATIONS.

          LEVEL SCHEME OF TH-230 /10/.
             NO.      ENERGY(MEV)  SPIN-PARITY
              G.S.    0.0            0 +
              1       0.0534         2 +
              2       0.173          4 +
              3       0.357          6 +
              4       0.506          1 -
              5       0.571          3 -
              6       0.635          0 +
              7       0.678          2 +
              8       0.682          5 -
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              9         0.781          2 +
             10         0.881          4 +
             11         0.951          1 -
             12         1.009          2 +
             13         1.012          3 -
          LEVELS ABOVE 1.02 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT=16,17  (N,2N) AND (N,3N) CROSS SECTIONS
      CALCULATED BY MEANS OF THE EVAPORATION MODEL OF SEGEV AND
      CANER /11/.
  MT=18   FISSION CROSS SECTION
      EVALUATION WAS MADE ON THE BASIS OF THE DATA OF MUIR ET
      AL. /12/ UP TO 2 MEV.  ABOVE 2 MEV, THE FISSION PROBABILITY
      DATA OF BACK ET AL. /13/ WERE USED TO CALCULATE THE FISSION
      CROSS SECTION.
  MT=102  CAPTURE CROSS SECTION
      STATISTICAL AND OPTICAL MODEL CALCULATIONS WITH GAMMA-RAY
      STRENGTH FUNCTION OF 0.00791.
  MT=251  MU-BAR
      CALCULATED WITH CASTHY.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,51-63,91
      STATISTICAL AND OPTICAL MODEL CALCULATIONS.
  MT=16,17,18
      ASSUMED TO BE ISOTROPIC IN THE LABORATORY SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,91
      EVAPORATION SPECTRA.
  MT=18
      FISSION SPECTRUM ESTIMATED FROM Z**2/A SYSTEMATICS BY SMITH
      ET AL. /14/.
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MAT number = 9040

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 90-TH-232 KINKI U.   EVAL-MAR87 T.OHSAWA
                      DIST-SEP89 REV2-AUG93
HISTORY
87-03 RE-VALUATION WAS MADE BY T. OHSAWA (KINKI UNIVERSITY).
      THE FOLLOWING PARTS OF PREVIOUS EVALUATION /1/ WERE REVISED
      WITH NEW ONE.
           RESONANCE PARAMETERS, ELASTIC AND INELASTIC SCATTERING,
           NU-P, NU-D, ENERGY DISTRIBUTIONS OF NEUTRONS.
88-09 FISSION CROSS SECTION WAS MODIFIED A LITTLE.
89-02 FISSION PRODUCT YIELDS (MF=8) WERE REPLACED WITH JNDC FP
      DECAY FILE VERSION-2.
89-04 FISSION SPECTRUM WAS MODIFIED.
      COMPILATION WAS MADE BY T. NAKAGAWA(JAERI).
93-08 JENDL-3.2.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (5,455)            RELATIVE ABUNDANCE OF THE 1-ST GROUP
     ***********************************************************


MF=1  GENERAL INFORMATION
  MT=451  DESCRIPTIVE DATA AND DICTIONARY
  MT=452  NUMBER OF NEUTRONS PER FISSION
      SUM OF PROMPT AND DELAYED NEUTRONS.
  MT=455  DELAYED NEUTRONS PER FISSION
      NU-D BASED ON TUTTLE'S RECOMMENDATION /2/.
  MT=456  PROMPT NEUTRONS PER FISSION
      TAKEN FROM DAVEY'S RECOMMENDATION /3/.

MF=2  RESONANCE PARAMETERS
  MT=151  RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
   RESOLVED RESONANCES FOR MLBW FORMULA : 1.0E-5 EV - 3.5 KEV
      THE PARAMETERS OF JENDL-2 WHICH WERE MAINLY BASED ON REF./4/
      AND BNL 325(3RD) WERE MODIFIED AS FOLLOWS:
      (1) FOR 22 RESONANCES IN THE LOWER ENERGY REGION WHICH MAKE
          MAJOR CONTRIBUTION TO THE RESONANCE INTEGRAL, THE NEW
          PARAMETERS OF KOBAYASHI /5/ WERE ADOPTED;
      (2) THE AVERAGE RADIATIVE WIDTH OF 24.7 MEV WERE ATTRIBUTED
          TO THOSE RESONANCES FOR WHICH THE RADIATIVE WIDTH WAS
          NOT KNOWN.
   UNRESOLVED RESONANCES : 3.5 KEV - 50 KEV
      AVERAGE RESONANCE PARAMETERS WERE GIVEN.  THE ENERGY
      DEPENDENT S0 AND S1 WERE CALCULATED SO AS TO REPRODUCE THE
      TOTAL AND CAPTURE CROSS SECTIONS IN THIS REGION.
      FIXED PARAMETERS :
        GG = 0.0212 EV, D-OBS = 18.64 EV, R = 10.01 FM.
      TYPICAL STRENGTH FUNCTIONS AT 10 KEV :
        S0 = 0.93E-4, S1 = 1.96E-4

   CALCULATED 2200-M/SEC CROSS SECTIONS AND RESONANCE INTEGRALS

                     2200 M/SEC        RES. INTEG.
         TOTAL         21.11 B            ---
         ELASTIC       13.70 B            ---
         FISSION        0.0  B           0.636 B
         CAPTURE        7.40 B          84.4 B

MF=3  NEUTRON CROSS SECTIONS
 BELOW 3.5 KEV :
      BACKGROUND CROSS SECTION IS GIVEN FOR THE CAPTURE.
 ABOVE 50 KEV :
  MT=1   TOTAL
      BASED ON THE EXPERIMENTAL DATA OF WHALEN/6/, FOSTER/7/ AND
      FASOLI/8/ IN THE SIZE RESONANCE REGION, AND KOBAYASHI/9/,
      WHALEN/6/ AND UTTLEY/10,11/ BELOW 1.5 MEV, AND OPTICAL MODEL
      CALCULATION ABOVE 14 MEV.
  MT=2   ELASTIC SCATTERING
      OBTAINED BY SUBTRACTING THE SUM OF CAPTURE, INELASTIC,
      FISSION, (N,2N), (N,3N) CROSS SECTIONS FROM THE TOTAL CROSS
      SECTION.
  MT=4   TOTAL INELASTIC SCATTERING CROSS SECTION
      SUM OF PARTIAL INELASTIC SCATTERING CROSS SECTIONS.
  MT=16   (N,2N)
      CALCULATED WITH THE MODEL OF SEGEV ET AL./12/.
  MT=17   (N,3N)
      CALCULATED WITH THE MODEL OF SEGEV ET AL./12/.
  MT=18   FISSION
      THE RATIO DATA TH-232/U-235 OF BEHRENS/13/ WERE MULTIPLIED
      WITH THE EVALUATED DATA/14/ OF U-235(N,F).
  MT=51-52  INELASTIC SCATTERING TO THE 1ST AND 2ND LEVELS.
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      CALCULATED WITH CONSISTENT COMBINATION OF COUPLED-CHANNEL
      (CC) AND HAUSER-FESHBACH(HF) METHODS (CC/HF METHOD)/15/.
      THE CODE JUPITOR-1/16/ WAS USED FOR CC-CALCULATIONS,
      ELIESE-3/17/ FOR THE HF-CALCULATIONS.
  MT=55,59,62,66 INELASTIC SCATTERING TO THE 5TH, 9TH, 12TH
          AND 16TH LEVELS.
      COMPOUND NUCLEAR COMPONENT WAS CALCULATED WITH THE CODE
      ELIESE-3 USING THE GENERALIZED TRANSMISSION COEFFICIENTS
      CALCULATED WITH JUPITOR-1 FOR THE ENTRANCE CHANNEL. DIRECT
      REACTION COMPONENT WAS CALCULATED WITH THE CODE DWUCK/18/.
  MT=53,54,56-58,60,61,63-65,67-70,91  INELASTIC SCATTERING
          TO THE OTHER DISCRETE AND CONTINUUM LEVELS.
      CALCULATED WITH ELIESE-3 USING THE GENERALIZED TRANS-
      MISSION COEFFICIENTS FOR THE ENTRANCE CHANNEL.
  MT=102 CAPTURE
      BASED ON THE MEASUREMENT OF KOBAYASHI/19/ AND CALCULATION
      WITH THE CODE CASTHY/20/.

      THE PARAMETERS FOR THE CC AND SPHERICAL OPTICAL POTENTIALS
  WERE TAKEN FROM HAOUAT ET AL./21/ AND OHSAWA ET AL./22/,
  RESPECTIVELY:
                  CC                       SOM
             V   = 46.4-0.3*EN       V   = 41.0-0.05*EN     (MEV)
             WS  = 3.6+0.4*EN        WS  = 6.4+0.15*SQRT(EN)(MEV)
             VSO= 6.2                VSO= 7.0               (MEV)
             R   = 1.26              R   = 1.31             (FM)
             RS  = 1.26              RS  = 1.38             (FM)
             RSO= 1.12               RSO= 1.31              (FM)
             A   = 0.63              A   = 0.47             (FM)
             AS  = 0.52              AS  = 0.47             (FM)
             ASO= 0.47               ASO= 0.47              (FM)
             BETA2=0.190
             BETA4=0.071

      THE LEVEL SCHEME WAS TAKEN FROM REF./23/.
            NO.          ENERGY(MEV)    SPIN-PARITY
            GS           0                  0+
             1           0.049              2+
             2           0.162              4+
             3           0.333              6+
             4           0.557              8+
             5           0.714              1-
             6           0.730              0+
             7           0.7741             2+
             8           0.7743             3-
             9           0.785              2+
            10           0.830              3-
            11           0.873              4+
            12           0.883              5-
            13           0.889              4+
            14           0.960              5+
            15           1.054              2-
            16           1.073              2+
            17           1.0777             1-
            18           1.078              0+
            19           1.094              3+
            20           1.105              3-
         CONTINUUM LEVELS WERE ASSUMED ABOVE 1.110MEV.
         THE LEVEL DENSITY PARAMETERS OF GILBERT AND CAMERON/24/
         WERE USED.

  MT=251  MU-BAR
      CALCULATED WITH THE OPTICAL MODEL.

MF=4   ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2     ELASTIC SCATTERING
      CALCULATED WITH CC/HF METHOD/15/.
  MT=51-70 INELASTIC
      CALCULATED WITH CC/HF METHOD/15/ AND DWBA/18/.
  MT=16,17,18,91  (N,2N), (N,3N), FISSION AND CONTINUUM INELASTIC
      ASSUMED TO BE ISOTROPIC IN THE LAB SYSTEM.

MF=5   ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,91  (N,2N), (N,3N) AND CONTINUUM INELASTIC
      CALCULATED WITH PEGASUS/25/.
  MT=18    FISSION
      MAXWELL SPECTRUM.  THE TEMPERATURE PARAMETERS WERE ESTIMATED
      FROM THE SYSTEMATICS OF HOWERTON-DOYAS/26/.
  MT=455  DELAYED NEUTRONS
      SPECTRUM EVAUATED BY SAPHIER ET AL./27/ WAS ADOPTED.
      RELATIVE ABUNDANCE WAS TAKEN FROM REF./28/.
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MF=8  FISSION PRODUCT YIELD DATA
  MT=454  INDEPENDENT YIELDS
      TAKEN FROM JNDC FP DECAY FILE VERSION-2/29/.
  MT=459  CUMULATIVE YIELDS
      TAKEN FROM JNDC FP DECAY FILE VERSION-2/29/.
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MAT number = 9043

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 90-TH-233 KINKI U.   EVAL-JUL87 T.OHSAWA
                      DIST-SEP89 REV2-JUN94
HISTORY
81-04 EVALUATION FOR JENDL-2 WAS MADE BY T. OHSAWA AND M. OHTA
      (KYUSHU UNIVERSITY: PRESENT ADDRESS OF OHSAWA IS KINKI
      UNIV.).  DETAILS OF THE EVALUATION ARE DESCRIBED IN REF.
      /1/.
83-11 FISSION SPECTRUM WAS ADDED.  THE TOTAL, (N,2N) AND (N,3N)
      CROSS SECTIONS WERE MODIFIED.
87-07 JENDL-2 DATA WERE ADOPTED FOR JENDL-3.
      COMPILATION WAS MADE BY T.NAKAGAWA (JAERI).
94-06 JENDL-3.2.
       NU-P, NU-D AND NU-TOTAL WERE MODIFIED.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (1,452), (1,455), (1,456)
     ***********************************************************


MF=1 GENERAL INFORMATION
  MT=451 COMMENT AND DICTIONARY
  MT=452 NUMBER OF NEUTRONS PER FISSION
      SUM OF NU-P NAD NU-D.
  MT=455 DELAYED NEUTRONS PER FISSION
      AVERAGE VALUES OF SYSTEMATICS BY TUTTLE/2/, BENEDETTI ET
      AL./3/ AND WALDO ET AL./4/  DECAY CONSTANTS WERE ASSUMED
      TO BE THE SAME AS THOSE OF TH-232 EVALUATED BY BRADY AND
      ENGLAND/5/.
  MT=456 PROMPT NEUTRONS PER FISSION
      BASED ON THE SEMI-EMPIRICAL FORMULA OF HOWERTON /6/.

MF=2  RESONANCE PARAMETERS
  MT=151  RESOLVED RESONANCES
      NO RESOLVED RESONANCES WERE ADOPTED, SINCE THERE WERE NO
      MEASUREMENTS MADE.  THE THERMAL CAPTURE CROSS SECTION OF
      1450+-100 BARNS WAS ADOPTED FROM REF./7/, AND THE THERMAL
      FISSION CROSS SECTION OF 15 BARNS FROM LLL EVALUATED NUCLEAR
      DATA LIBRARY/8/.  THE CAPTURE AND FISSION CROSS SECTIONS AT
      0.0253 EV WERE EXTRAPOLATED UP TO 200 EV BY ASSUMING THE
      FORM OF 1/V FOR THE FORMER, AND UP TO 20 KEV BY ASSUMING THE
      FORM OF 1/V PLUS THE CONSTANT VALUE OF 0.3 BARNS FOR THE
      LATTER.

      CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEG.(BARNS)
                        2200-M/S      RES. INTEG.
              TOTAL      1478.0          -
              ELASTIC      13.0          -
              FISSION      15.0         11.1
              CAPTURE    1450.0        643

MF=3  NEUTRON CROSS SECTIONS
  MT=1    TOTAL CROSS SECTION
      OPTICAL MODEL CALCULATION WITH THE FOLLOWING PARAMETERS:
         V  = 41.0 - 0.05*E      (MEV),
         WS = 6.4 + 0.15*SQRT(E) (MEV),  -- DER. WOODS-SAXON --
         VSO= 7.0                (MEV),
         R0 = RSO = 1.31         (FM),
         RS = 1.38               (FM),
         A  = B  = ASO= 0.47     (FM).
      THESE PARAMETERS WERE TAKEN FROM THOSE FOR TH-232 /9/.
  MT=2    ELASTIC SCATTERING CROSS SECTION
      STATISTICAL AND OPTICAL MODEL CALCULATIONS USING THE CODE
      CASTHY /10/.
  MT=4,51-65,91  INELASTIC SCATTERING CROSS SECTION
      STATISTICAL AND OPTICAL MODEL CALCULATIONS.

          LEVEL SCHEME OF TH-233 /11/.
             NO.      ENERGY(MEV)  SPIN-PARITY
              G.S.     0.0           1/2 +
              1        0.01687       3/2 +
              2        0.05456       5/2 +
              3        0.09363       7/2 +
              4        0.37121       5/2 +
              5        0.53958       1/2 -
              6        0.58393       1/2 +
              7        0.6115        3/2 +
              8        0.62902       5/2 +
              9        0.6822        3/2 -
             10        0.7135        1/2 +
             11        0.7218        3/2 +
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               12        0.7695         5/2 +
               13        0.8145         3/2 +
               14        0.8914         3/2 +
               15        0.9476         3/2 -
            LEVELS ABOVE 0.95 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT=16,17  (N,2N) AND (N,3N) CROSS SECTIONS
      CALCULATED BY MEANS OF THE EVAPORATION MODEL OF SEGEV AND
      CANER /12/.
  MT=18    FISSION CROSS SECTION
      FISSION PROBABILITY DEDUCED FROM DIRECT REACTION /13, 14/
      WAS USED TO CALCULATE THE FISSION CROSS SECTION.
  MT=102  CAPTURE CROSS SECTION
      STATISTICAL AND OPTICAL MODEL CALCULATIONS WITH GAMMA-RAY
      STRENGTH FUNCTION OF 0.00352.
  MT=251  MU-BAR
      CALCULATED WITH OPTICAL MODEL.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,51-65,91
      STATISTICAL AND OPTICAL MODEL CALCULATIONS.
  MT=16,17,18
      ASSUMED TO BE ISOTROPIC IN THE LABORATORY SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,91
      EVAPORATION SPECTRA.
  MT=18
      FISSION SPECTRUM ESTIMATED FROM Z**2/A SYSTEMATICS OF SMITH
      ET AL. /15/
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MAT number = 9046

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 90-TH-234 KINKI U.    EVAL-JUL87 T.OHSAWA
                       DIST-SEP89 REV2-JUN94
HISTORY
81-04 EVALUATION FOR JENDL-2 WAS MADE BY T. OHSAWA AND M. OHTA
      (KYUSHU UNIVERSITY: PRESENT ADDRESS OF OHSAWA IS KINKI
      UNIV.).  DETAILS OF THE EVALUATION ARE DESCRIBED IN REF.
      /1/.
83-11 FISSION SPECTRUM WAS GIVEN.  THE TOTAL, (N,2N) AND (N,3N)
      CROSS SECTIONS WERE MODIFIED.
87-07 JENDL-2 DATA WERE ADOPTED FOR JENDL-3.
         COMPILATION WAS MADE BY T.NAKAGAWA(JAERI).
94-06 JENDL-3.2.
       NU-P, NU-D AND NU-TOTAL WERE MODIFIED.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (1,452), (1,455), (1,456)
     ***********************************************************


MF=1 GENERAL INFORMATION
  MT=451 COMMENT AND DICTIONARY
  MT=452 NUMBER OF NEUTRONS PER FISSION
      SUM OF NU-P NAD NU-D.
  MT=455 DELAYED NEUTRONS PER FISSION
      AVERAGE VALUES OF SYSTEMATICS BY TUTTLE/2/, BENEDETTI ET
      AL./3/ AND WALDO ET AL./4/  DECAY CONSTANTS WERE ASSUMED
      TO BE THE SAME AS THOSE OF TH-232 EVALUATED BY BRADY AND
      ENGLAND/5/.
  MT=456 PROMPT NEUTRONS PER FISSION
      BASED ON THE SEMI-EMPIRICAL FORMULA OF HOWERTON /6/.

MF=2  RESONANCE PARAMETERS
  MT=151  RESOLVED RESONANCES
      NO RESOLVED RESONANCES WERE ADOPTED, SINCE THERE WERE NO
      MEASUREMENTS MADE.  THE CAPTURE CROSS SECTION AT 0.0253 EV
      /7/ WAS EXTRAPOLATED ON AN 1/V BASIS UP TO AN ENERGY OF 15
      EV. THE FISSION CROSS SECTION AT 0.0253 EV IS LESS THAN 0.02
      BARN /8/, THEREFORE IT WAS ASSUMED TO 0.0 BARN.

      CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEG.(BARNS)
                        2200-M/S       RES. INTEG.
              TOTAL       14.75            -
              ELASTIC     13.0             -
              FISSION      0.0              0.26
              CAPTURE      1.75            93.7

MF=3  NEUTRON CROSS SECTIONS
  MT=1    TOTAL CROSS SECTION
      OPTICAL MODEL CALCULATION WITH THE FOLLOWING PARAMETERS:
         V  = 41.0 - 0.05*E        (MEV),
         WS = 6.4 + 0.15*SQRT(E)  (MEV),  -- DER. WOODS-SAXON --
         VSO= 7.0                  (MEV),
         R0 = RSO = 1.31           (FM),
         RS = 1.38                 (FM),
         A  = B  = ASO= 0.47       (FM).
      THESE PARAMETERS WERE TAKEN FROM THOSE FOR TH-232 /9/.
  MT=2    ELASTIC SCATTERING CROSS SECTION
      STATISTICAL AND OPTICAL MODEL CALCULATIONS USING THE CODE
      CASTHY /10/.
  MT=4,51-67,91  INELASTIC SCATTERING CROSS SECTION
      STATISTICAL AND OPTICAL MODEL CALCULATIONS.

          LEVEL SCHEME OF TH-234 (ESTIMATED FROM SYSTEMATICS)
             NO.     ENERGY(MEV)  SPIN-PARITY
              G.S.    0.0           0 +
              1       0.048         2 +
              2       0.160         4 +
              3       0.336         6 +
              4       0.576         8 +
              5       0.730         0 +
              6       0.767         2 +
              7       0.785         2 +
              8       0.853         4 +
              9       0.882         1 -
             10       0.889         4 +
             11       0.942         3 -
             12       0.987         6 +
             13       1.050         5 -
             14       1.053         6 +
             15       1.073         8 +
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            16        1.206           7 +
            17        1.277           8 +
         LEVELS ABOVE 1.06 MEV WERE ASSUMED TO BE OVERLAPPING.

  MT=16,17  (N,2N) AND (N,3N) CROSS SECTIONS
      CALCULATED BY MEANS OF THE EVAPORATION MODEL OF SEGEV AND
      CANER /11/.
  MT=18   FISSION CROSS SECTION
      FISSION PROBABILITY DEDUCED FROM DIRECT REACTION /12/ AND
      SYSTEMATICS OF BEHRENS /13/ WERE USED TO OBTAIN FISSION
      CROSS SECTION.
  MT=102  CAPTURE CROSS SECTION
      STATISTICAL AND OPTICAL MODEL CALCULATIONS WITH GAMMA-RAY
      STRENGTH FUNCTION OF 0.00791.
  MT=251  MU-BAR
      CALCULATED WITH OPTICAL MODEL.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,51-67,91
      STATISTICAL AND OPTICAL MODEL CALCULATIONS.
  MT=16,17,18
      ASSUMED TO BE ISOTROPIC IN THE LABORATORY SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,91
      EVAPORATION SPECTRA WERE GIVEN.
  MT=18
      FISSION SPECTRUM WAS ESTIMATED FROM Z**2/A SYSTEMATICS
      OF SMITH ET AL. /14/.
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MAT number = 9131

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 91-PA-231 KINKI U.+  EVAL-MAR87 T.OHSAWA, M.INOUE AND T.NAKAGAWA
                      DIST-SEP89
HISTORY
87-03 NEW EVALUATION WAS PERFORMED FOR JENDL-3 BY T. OHSAWA AND
      M. INOUE.
87-07 RESONANCE PARAMETERS WERE EVALUATED BY T.NAKAGAWA(JAERI).
88-07 UNRESOLVED RESONANCE REGION WAS MODIFIED.
COMPILATION WAS MADE BY T.NAKAGAWA.

MF=1    GENERAL INFORMATION
   MT=451   DESCRIPTIVE DATA AND DICTIONARY
   MT=452   NUMBER OF NEUTRONS PER FISSION
        SUM OF MT'S = 455 AND 456.
   MT=455   DELAYED NEUTRONS
        DECAY CONSTS  WERE ASSUMED TO BE SAME AS THORIUM.
        NU-D WAS EVALUATED ON THE BASIS OF TUTTLE'S RECOMMENDA-
        TION/1/.
   MT=456   NUMBER OF PROMPT NEUTRONS PER FISSION
        BASED ON THE BOIS-FREHAUT'S SEMI-EMPIRICAL FORMULA /2/.

MF=2, MT=151     RESONANCE PARAMETERS
   RESOLVED RESONANCES FOR SLBW FORMULA: 1.0-5 - 115 EV
        NEUTRON AND RADIATIVE WIDTHS WERE MAINLY ADOPTED FROM
        HUSSEIN ET AL./3/, AND FISSION WIDTH ESTIMATED FROM THE
        DATA OF FISSION AREA MEASURED BY PLATTERD ET AL. /4/.
        FOR THE RESONANCES WHOSE FISSION AREA WAS NOT MEASURED,
        AN AVERAGE VALUE OF 40 MICRO-EV WAS ASSUMED.  A NEGATIVE
        RESONANCE WAS GIVEN ON THE BASIS OF RECOMMENDATION BY
        MUGHABGHAB /5/ TO REPRODUCE RECOMMENDED THERMAL CROSS
        SECTIONS /5/.
   UNRESOLVED RESONANCES : 115 EV - 40 KEV
        PARAMETERS WERE BASED ON THE AVERAGE VALUES OBTAINED FROM
        THE RESOLVED RESONANCE PARAMETERS.  S1 WAS DETERMINED
        FROM THE OPTICAL MODEL CALCULATION.  SCATTERING RADIUS WAS
        ADJUSTED SO AS TO REPRODUCE ELASTIC SCATTERING AT 40 KEV.
          S0 = 0.90E-4, S1 = 1.2E-4, D-OBS = 0.47EV,
          RADIATIVE WIDTH = 0.040 EV, R = 9.05 FM
        BACKGROUND CROSS SECTION WAS GIVEN TO THE CAPTURE CROSS
        SECTION TO CONNECT SMOOTHLY TO THAT IN HIGH ENERGY REGION.

   CALCULATED 2200-M/S CROSS SECTIONS AND RESONANCE INTEGRALS
                    2200 M/S         RESONANCE INTEGRALS
      TOTAL         210.69 B              -
      ELASTIC         9.954               -
      FISSION         0.0196            4.61 B
      CAPTURE       200.72              596  B

MF=3  NEUTRON CROSS SECTIONS
       CROSS SECTION WERE REPRESENTED WITH RESONANCE PARAMETERS
       BELOW 40 KEV.  ABOVE THIS ENERGY, CROSS SECTIONS WERE
       EVALUATED AS FOLLOWS.

    MT=1  TOTAL CROSS SECTION
       CALCULATED WITH THE COUPLED-CHANNEL(CC) MODEL CODE
       JUPITOR-1/6/. THE POTENTIAL PARAMETERS USED FOR THE CC-
       CALCULATIONS ARE GIVEN BELOW.

    MT=2  ELASTIC SCATTERING
       OBTAINED BY SUBTRACTING THE SUM OF CAPTURE, INELASTIC,
       FISSION, (N,2N) AND (N,3N) REACTION CROSS SECTIONS FROM THE
       TOTAL CROSS SECTION.

    MT=16  (N,2N)
       CALCULATED WITH THE MODEL OF SEGEV ET AL./7/.

    MT=17  (N,3N)
       CALCULATED WITH THE MODEL OF SEGEV ET AL./7/.

    MT=18  FISSION
       BASED ON THE EXPERIMENTAL DATA OF PLATTARD/4/ BELOW 12 MEV.
       ABOVE 12 MEV, THE EVALUATION OF MANN/9/ WAS ADOPTED AFTER
       APPROPRIATE RENORMALIZATION.

    MT=53,63  INELASTIC SCATTERING TO THE 3RD AND 13TH EXCITED
             LEVELS(MEMBERS OF THE GROUND STATE ROTATIONAL BAND).
       CALCULATED WITH THE CONSISTENT COMBINATION OF CC AND
       HAUSER-FESHBACH(HF) METHODS (CC/HF METHOD)/9/. THE CODE
       JUPITOR-1 WAS USED FOR THE CC CALCULATIONS, AND ELIESE-3
       /10/ FOR THE HF CALCULATIONS.

    MT=51-52,54-62,64-70,91  INELASTIC SCATTERING TO THE OTHER
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DISCRETE AND CONTINUUM LEVELS.
COMPOUND NUCLEAR COMPONENT WAS CALCULATED WITH THE CODE ELIESE-3 USING THE GENERALIZED TRANSMISSION COEFFICIENTS CALCULATED WITH JUPITOR-1 FOR THE ENTRANCE CHANNEL. THE LEVEL DENSITY PARAMETERS WERE TAKEN FROM GILBERT-CAMERON /11/.

MT=102 CAPTURE
CALCULATED WITH THE CODE CASTHY/12/. THE AVERAGE RADIATIVE WIDTH AND LEVEL SPACING USED TO NORMALIZE THE CALCULATION ARE 40 MEV AND 0.47 EV, RESPECTIVELY/3/.

THE PARAMETERS FOR THE CC AND SPHERICAL OPTICAL POTENTIALS WERE TAKEN FROM HAOUAT ET AL./13/ AND OHSAWA ET AL./14/ RESPECTIVELY.

CC	SOM	
V = 46.4-0.3*EN	V = 41.0-0.05*EN	(MEV)
WS = 3.6+0.4*EN	WS = 6.4+0.15*SQRT(EN)	(MEV)
VSO= 6.2	VSO= 7.0	(MEV)
R = 1.26	R = 1.31	(FM)
RS = 1.26	RS = 1.38	(FM)
RSO= 1.12	RSO= 1.31	(FM)
A = 0.63	A = 0.47	(FM)
AS = 0.52	AS = 0.52	(FM)
ASO= 0.47	ASO= 0.47	(FM)
BETA2=0.190	---	
BETA4=0.071	---	

THE LEVEL SCHEME WAS TAKEN FROM NUCLEAR DATA SHEETS/15/.

NO.	ENERGY(MEV)	SPIN-PARITY
GS	0.0	3/2-
1	0.0093	1/2-
2	0.0585	7/2-
3	0.0778	5/2-
4	0.0842	5/2+
5	0.1013	7/2+
6	0.1029	3/2+
7	0.1116	9/2+
8	0.1340	11/2+
9	0.1693	11/2-
10	0.1741	5/2-
11	0.1835	5/2+
12	0.189	13/2+
13	0.2183	7/2-
14	0.2473	7/2+
15	0.2720	9/2-
16	0.287	1/2+
17	0.3179	3/2+
18	0.3202	3/2-
19	0.3400	11/2-
20	0.3518	5/2-

CONTINUUM LEVELS WERE ASSUMED ABOVE 0.38 MEV. THE LEVEL DENSITY PARAMETERS WERE TAKEN FROM GILBERT-CAMERON/11/.

MT=251 MU-BAR
CALCULATED WITH THE OPTICAL MODEL.

MF=4 ANGULAR DISTRIBUTION OF SECONDARY NEUTRONS

MT=2 ELASTIC SCATTERING
CALCULATED WITH THE CC/HF METHOD.

MT=51-70 INELASTIC SCATTERING
CALCULATED WITH THE CC/HF METHOD FOR THE 3RD AND 13TH EXCITED LEVELS. FOR THE OTHER LEVELS, CALCULATIONS WITH ELIESE-3 USING THE GENERALIZED TRANSMISSION COEFFICIENTS FOR THE ENTRANCE CHANNEL WERE ADOPTED, AND ISOTROPIC DISTRIBUTIONS WERE ASSUMED ABOVE 5.0 MEV BECAUSE OF ZERO CROSS SECTIONS.

MT=91 INELASTIC SCATTERING TO THE CONTINUUM
ISOTROPIC DISTRIBUTIONS IN LAB. SYSTEM WAS ASSUMED.

MF=5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS

MT=16,17,91 (N,2N), (N,3N) AND CONTINUUM INELASTIC
EVAPORATION SPECTRA.

MT=18 FISSION
MAXWELL SPECTRUM (TAKEN FROM ENDF/B-V).

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MAT number = 9134
 91-PA-232 TIT          EVAL-AUG88 N.TAKAGI
                        DIST-SEP89 REV2-JUN94
HISTORY
88-08 NEW EVALUATION WAS MADE BY N. TAKAGI (TOKYO INSTITUTE OF
      TECHNOLOGY, TIT) /1/.
94-06 JENDL-3.2.
       NU-P, NU-D AND NU-TOTAL WERE MODIFIED.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (1,452), (1,455), (1,456)
     ***********************************************************


MF=1 GENERAL INFORMATION
  MT=451 COMMENT AND DICTIONARY
  MT=452 NUMBER OF NEUTRONS PER FISSION
       SUM OF NU-P NAD NU-D.
  MT=455 DELAYED NEUTRONS PER FISSION
       AVERAGE VALUES OF SYSTEMATICS BY TUTTLE/2/, BENEDETTI ET
       AL./3/ AND WALDO ET AL./4/  DECAY CONSTANTS WERE ADOPTED
       FROM THE EVALUATION BY BRADY AND ENGLAND/5/.
  MT=456 PROMPT NEUTRONS PER FISSION
       BASED ON SYSTEMATICS BY MANERO AND KONSHIN/6/, AND BY
       HOWERTON/7/.

MF=2  RESONANCE PARAMETERS
  MT=151   RESONANCE PARAMETERS
    NO RESONANCE PARAMETERS WERE GIVEN.

  2200-M/S CROSS SECTIONS AND RESONANCE INTEGRALS
                      2200 M/S VALUE       RES. INT.
        TOTAL          1176.23  B              -
        ELASTIC          12.23  B              -
        FISSION         700.00  B            313 B
        CAPTURE         464.00  B            309 B

MF=3  NEUTRON CROSS SECTIONS
  MT=1  TOTAL CROSS SECTION
        BELOW 1 EV, CALCULATED AS SUM OF MT'S = 2, 18 AND 102.
        ABOVE 1 EV, OPTICAL MODEL CALCULATION WAS MADE WITH
        CASTHY/8/.  THE POTENTIAL PARAMETERS/9/ USED ARE AS
        FOLLOWS.
           V = 41.0 - 0.05*EN                           (MEV)
           WS= 6.4 - 0.15*SQRT(EN)                      (MEV)
           WV= 0               , VSO = 7.0              (MEV)
           R = RSO = 1.31      , RS = 1.38               (FM)
           A = ASO = 0.47      , B  = 0.47               (FM)

  MT=2  ELASTIC SCATTERING CROSS SECTION
        BELOW 1 EV, ASSUMED TO BE THE SAME AS SHAPE ELASTIC
        SCATTERING CROSS SECTION CALCULATED WITH THE OPTICAL
        MODEL.  ABOVE 1 EV, OPTICAL MODEL CALCULATION WAS
        ADOPTED.

  MT=4, 91  INELASTIC SCATTERING CROSS SECTIONS.
        OPTICAL AND STATISTICAL MODEL CALCULATION WAS MADE WITH
        CASTHY/8/.  NO EXCITED LEVELS WERE RECOMMENDED IN
        REF./10/.
                  NO          ENERGY(KEV)   SPIN-PARITY
                 G.S.              0.0          2 -
        LEVELS ABOVE 50 KEV WERE ASSUMED TO BE OVERLAPPING.
        THE LEVEL DENSITY PARAMETERS WERE TAKEN FROM REF./11/.

  MT=16,17,37  (N,2N), (N,3N) AND (N,4N) REACTION CROSS SECTIONS
        CALCULATED WITH EVAPORATION MODEL.

  MT=18  FISSION CROSS SECTION
        MEASURED THERMAL CROSS SECTION OF 700 BARNS WAS TAKEN FROM
        REF./12/, AND 1/V FORM WAS ASSUMED BELOW 1 EV.  FOR
        ENERGIES ABOVE 1 EV, THE SHAPE WAS ASSUMED TO BE THE SAME
        AS U-233 FISSION CROSS SECTION AND NORMALIZED TO THE
        SYSTEMATICS BY BEHRENS AND HOWERTON/13/.

  MT=102  CAPTURE CROSS SECTION
        MEASURED THERMAL CROSS SECTION OF 464 BARNS WAS TAKEN FROM
        REF./12/, AND 1/V FORM WAS ASSUMED BELOW 1 EV.  THE CROSS
        SECTION SHAPE NEAR 1 EV WAS ADJUSTED SO AS TO REPRODUCE
        THE RESONANCE INTEGRAL/12/.  ABOVE 1 EV, CALCULATED WITH
        CASTHY. THE GAMMA-RAY STRENGTH FUNCTION WAS ESTIMATED FROM
        GAMMA-GAMMA = 0.040 EV AND LEVEL SPACING = 0.417 EV.
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  MT=251  MU-L
        CALCULATED WITH CASTHY.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,91               CALCULATED WITH OPTICAL MODEL.
  MT=16,17,18,37        ISOTROPIC IN THE LAB SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,37,91        EVAPORATION SPECTRA
         OBTAINED FROM LEVEL DENSITY PARAMETERS.

  MT=18                 MAXWELLIAN FISSION SPECTRUM.
        TEMPERATURE WAS ESTIMATED FROM Z**2/A DEPENDENCE/14/.
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MAT number = 9137

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 91-PA-233 KINKI U.+  EVAL-MAR87 T.OHSAWA, M.INOUE AND T.NAKAGAWA
                      DIST-SEP89
HISTORY
87-03 RE-EVALUATION WAS PERFORMED FOR JENDL-3 BY T. OHSAWA,
      M. INOUE (KYUSHU UNIVERSITY) AND T.NAKAGAWA(JAERI)
COMPILATION WAS MADE BY T.NAKAGAWA.

MF=1    GENERAL INFORMATION
   MT=451   DESCRIPTIVE DATA AND DICTIONARY
   MT=452   NUMBER OF NEUTRONS PER FISSION
      SUM OF NU-P (MT=456) AND NU-D (MT=455)
   MT=455   NUMBER OF DELAYED NEUTRONS
      TAKEN FROM TUTTLE'S SEMI-EMPIRICAL FORMULA /1/.  ENERGY
      DEPENDENCE WAS IGNORED.
   MT=456   NUMBER OF PROMPT NEUTRONS
      BASED ON THE SEMI-EMPIRICAL FORMULA BY BOIS AND FREHAUT /2/.

MF=2, MT=151     RESONANCE PARAMETERS
   RESOLVED RESONANCES FOR SLBW FORMULA: FROM 1.0E-5 TO 16.5 EV
      PARAMETERS WERE TAKEN FROM THE RECOMMENDATION BY MUGHABGHAB
      /3/ AND MODIFIED TO REPRODUCE THERMAL CROSS SECTIONS AND
      RESONANCE INTEGRAL OF CAPTURE/3/.
   UNRESOLVED RESONANCE PARAMETERS: FROM 16.5 EV TO 40 KEV
      AVERAGE RESONANCE PARAMETERS RECOMMENDED BY MUGHABGHAB /3/
      WERE ADOPTED.
          S0 = 0.75E-4,  S1 = 1.5E-4, D-OBS = 0.59 EV,
          GAMMA WIDTH = 0.047 EV
         (S1 WAS ADJUSTED WITH ASREP/5/ SO AS TO REPRODUCE TOTAL
          AND CAPTURE CROSS SECTIONS AROUND 20 KEV.)

   CALCULATED 2200-M/S CROSS SECTIONS AND RESONANCE INTEGRALS
                     2200-M/S           RES. INTEG.
      TOTAL          53.051 B
      ELASTIC        13.021
      FISSION         0.0                 2.1 B
      CAPTURE        40.031             864


MF=3  NEUTRON CROSS SECTIONS
  BELOW 40 KEV, THE RESONANCE PARAMETERS WERE GIVEN.  ABOVE 40
  KEV, CROSS SECTIONS WERE EVALUATED AS FOLLOWS.

    MT=1  TOTAL CROSS SECTION
       CALCULATED WITH THE COUPLED-CHANNEL(CC) MODEL CODE
       JUPITOR-1/5/. THE POTENTIAL PARAMETERS USED FOR THE CC-
       CALCULATIONS ARE GIVEN BELOW.

    MT=2  ELASTIC SCATTERING
       OBTAINED BY SUBTRACTING THE SUM OF CAPTURE, INELASTIC,
       FISSION, (N,2N) AND (N,3N) REACTION CROSS SECTIONS FROM THE
       TOTAL CROSS SECTION.

    MT=16  (N,2N)
       CALCULATED WITH THE MODEL OF SEGEV ET AL./6/.

    MT=17  (N,3N)
       CALCULATED WITH THE MODEL OF SEGEV ET AL./6/.

    MT=18  FISSION
       CALCULATED USING THE EXPERIMENTAL DATA ON THE FISSION
       PROBABILITY/7/.

    MT=53,66  INELASTIC SCATTERING TO THE 3RD AND 16TH EXCITED
           LEVELS(MEMBERS OF THE GROUND STATE ROTATIONAL BAND).
       CALCULATED WITH THE CONSISTENT COMBINATION OF CC AND
       HAUSER-FESHBACH(HF) METHODS (CC/HF METHOD)/8/. THE CODE
       JUPITOR-1 WAS USED FOR THE CC CALCULATIONS, AND ELIESE-3
       /9/ FOR THE HF CALCULATIONS.

    MT=51-52,54-65,67-70,91  INELASTIC SCATTERING TO THE OTHER
           DISCRETE AND CONTINUUM LEVELS.
       COMPOUND NUCLEAR COMPONENT WAS CALCULATED WITH THE CODE
       ELIESE-3 USING THE GENERALIZED TRANSMISSION COEFFICIENTS
       CALCULATED WITH JUPITOR-1  FOR THE ENTRANCE CHANNEL. THE
       LEVEL DENSITY PARAMETERS WERE TAKEN FROM GILBERT-CAMERON
       /10/.

    MT=102  CAPTURE
       CALCULATED WITH THE CODE CASTHY/11/.  THE AVERAGE RADIATIVE
       WIDTH AND LEVEL SPACING USED TO NORMALIZE THE CALCULATION
       ARE 40 MEV AND 0.79 EV, RESPECTIVELY/12/.
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THE PARAMETERS FOR THE CC AND SPHERICAL OPTICAL POTENTIALS
WERE TAKEN FROM HAOUAT ET AL./13/ AND OHSAWA ET AL./14/
RESPECTIVELY.
            CC                         SOM
   V   = 46.4-0.3*EN        V   = 41.0-0.05*EN        (MEV)
   WS  =  3.6+0.4*EN        WS  =  6.4+0.15*SQRT(EN)(MEV)
   VSO=  6.2                VSO=  7.0                 (MEV)
   R   =  1.26              R   =  1.31               (FM)
   RS  =  1.26              RS  =  1.38               (FM)
   RSO=  1.12               RSO=  1.31                (FM)
   A   =  0.63              A   =  0.47               (FM)
   AS  =  0.52              AS  =  0.52               (FM)
   ASO=  0.47               ASO=  0.47                (FM)
   BETA2=0.190                    ---
   BETA4=0.071                    ---

THE LEVEL SCHEME WAS TAKEN FROM NUCLEAR DATA SHEETS/15/,
EXCEPT THE 300.4 KEV-LEVEL, FOR WHICH 7/2- WAS ADOPTED
INSTEAD OF 7/2+ ACCORDING TO THE SUGGESTION OF GONZALEZ/16/.
         NO.          ENERGY(MEV)        SPIN-PARITY
         GS             0.0                 3/2-
          1             0.0067              1/2-
          2             0.0572              7/2-
          3             0.0706              5/2-
          4             0.0865              5/2+
          5             0.0947              3/2+
          6             0.1036              7/2+
          7             0.1090              9/2+
          8             0.1634             11/2+
          9             0.1691              1/2+
         10             0.1792              9/2-
         11             0.2017              3/2+
         12             0.2123              5/2+
         13             0.2379              9/2+
         14             0.2573              5/2-
         15             0.2796              7/2+
         16             0.3004              7/2-
         17             0.3061              7/2+
         18             0.3661              9/2+
         19             0.4477              3/2-
         20             0.4546              3/2+
   CONTINUUM LEVELS WERE ASSUMED ABOVE 0.5 MEV. THE LEVEL
   DENSITY PARAMETERS WERE TAKEN FROM GILBERT-CAMERON/7/.

 MT=251   MU-BAR
   CALCULATED FROM ANGULAR DISTRIBUTIONS.

MF=4  ANGULAR DISTRIBUTION OF SECONDARY NEUTRONS

 MT=2   ELASTIC SCATTERING
   CALCULATED WITH THE CC/HF METHOD.

 MT=51-70  INELASTIC SCATTERING
   CALCULATED WITH THE CC/HF METHOD FOR THE 3RD AND 13TH
   EXCITED LEVELS. FOR THE OTHER LEVELS, CALCULATIONS WITH
   ELIESE-3 USING THE GENERALIZED TRANSMISSION COEFFICIENTS
   FOR THE ENTRANCE CHANNEL WERE ADOPTED.

 MT=91  INELASTIC SCATTERING TO THE CONTINUUM
   ISOTROPIC DISTRIBUTION WAS ASSUMED IN THE LABORATORY
   SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS

 MT=16,17,91  (N,2N), (N,3N) AND CONTINUUM INELASTIC
   EVAPORATION SPECTRA BASED ON THE LEVEL DENSITY PARAMETERS

 MT=18  FISSION
   MAXWELL SPECTRUM (TAKEN FROM ENDF/B-V).
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MAT number = 9219
 92-U -232 KINKI U.+  EVAL-MAR87 T.OHSAWA AND T. NAKAGAWA
                      DIST-SEP89 REV2-MAR94
HISTORY
87-03 EVALUATION WAS CARRIED OUT BY T. OHSAWA (KINKI UNIVERSITY)
      AND T. NAKAGAWA (JAERI).
            T.NAKAGAWA: RESONANCE PARAMETERS
            T.OHSAWA  : OTHER QUANTITIES
      COMPILATION WAS MADE BY T.NAKAGAWA (JAERI).
94-03 JENDL-3.2

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (3,102)      ONLY Q-VALUE WAS MODIFIED.
     ***********************************************************


MF=1  GENERAL INFORMATION
  MT=451   DESCRIPTIVE DATA AND DICTIONARY
  MT=452   TOTAL NUMBER OF NEUTRONS PER FISSION
     SUM OF NU-P AND NU-D
  MT=455   NUMBER OF DELAYED NEUTRONS
     DETERMINED FROM TUTTLE'S SEMI-EMPIRICAL FORMULA /1/.
  MT=456   NUMBER OF PROMPT NEUTRONS
     BASED ON THE SEMI-EMPIRICAL FORMULA BY BOIS AND FREHAUT /2/.

MF=2, MT=151        RESONANCE PARAMETERS
   RESOLVED RESONANCE PARAMETERS  (FROM 1.0E-5 TO 200 EV)
     RECOMMENDATION BY MUGHABGHAB /3/ WAS ADOPTED, AND ITS FORMULA
     WAS CHANGED FROM REICH-MOORE TO MULTILEVEL BREIT- WIGNER
     TYPE.  BACKGROUND CROSS SECTION WAS GIVEN TO REPRODUCE
     MEASURED FISSION CROSS SECTIONS /4,5/ AT VALLEYS OF LEVELS.

   CALCULATED 2200-M/S CROSS SECTIONS AND RESONANCE INTEGRALS
                     2200-M/S           RES. INTEG.
     TOTAL           162.3  B
     ELASTIC          10.79 B
     FISSION          76.66 B             364 B
     CAPTURE          74.88 B             173 B
              THESE VALUES ARE ALMOST THE SAME AS RECOMMENDATION
              BY MUGHABGHAB/3/ EXCEPT CAPTURE RESONANCE INTEGRAL
              WHICH IS RECOMMENDED AS 280+-15 BARNS.

MF=3  NEUTRON CROSS SECTIONS
   ABOVE 200 EV
   MT=1  TOTAL
         CALCULATED WITH THE SPHERICAL OPTICAL MODEL.

         THE PARAMETERS FOR THE SPHERICAL OPTICAL PARAMETERS WERE
         AS FOLLOWS:

           V = 40.47 - 0.06*EN      (MEV),  VSO = 8.8 (MEV)
           WS = 6.8 + 0.04*SQRT(EN) (MEV),  WV = 0.0
           R = 1.32  (FM), RS = 1.38 (FM), RSO = 1.22 (FM)
           A = AS = ASO = 0.47  (FM),

         THIS SET OF PARAMETERS WAS FOUND TO GIVE GOOD AGREEMENT
         WITH THE MEASUREMENTS OF SIMPSON ET AL./6/ IN THE ENERGY
         REGION FROM 1 KEV TO 10 KEV.
   MT=2   ELASTIC SCATTERING
         CALCULATED WITH THE CODE CASTHY/7/.
   MT=16  (N,2N)
         CALCULATED WITH THE MODEL OF SEGEV-FAHIMA/8/.
   MT=17  (N,3N)
         CALCULATED WITH THE MODEL OF SEGEV-FAHIMA/8/.
   MT=18   FISSION
         CALCULATED  BY USING  THE FISSION PROBABILITY DATA OF
         GAVRON ET AL./9/ AND COMPOUND FORMATION CROSS SECTIONS
         CALCULATED WITH THE OPTICAL MODEL. BELOW 1 KEV, THE CROSS
         SECTION WAS DETERMINED ON THE BASIS OF FARRELL /5/.
   MT=51-60,91   INELASTIC SCATTERING TO THE DISCRETE AND CON-
         TINUOUS LEVELS
         CALCULATED WITH THE CODE CASTHY/7/. THE LEVEL SCHEME WAS
         TAKEN FROM LEDERER ET AL./10/ AND SCHMORAK/11/.
               NO.       ENERGY(MEV)   SPIN-PARITY
               GS          0.0           0+
                1          0.048         2+
                2          0.157         4+
                3          0.323         6+
                4          0.541         8+
                5          0.563         1-
                6          0.629         3-
                7          0.692         0+
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              8           0.736           2+
              9           0.805          10+
             10           0.867           2+
       CONTINUUM REGION WAS ASSUMED ABOVE 1.0 MEV.  THE LEVEL
       DENSITY PARAMETERS OF GILBERT-CAMERON/12/ WERE USED.
   MT=102  CAPTURE
       CALCULATED WITH THE CODE CASTHY/7/.
   MT=251  MU-BAR
       CALCULATED WITH THE CODE CASTHY/7/.

MF=4   ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
   MT=2  ELASTIC SCATTERING
       CALCULATED WITH THE CODE CASTHY/7/.
   MT=51-60,91 INELASTIC SCATTERING
       CALCULATED WITH THE CODE CASTHY/7/.
   MT=16,17 (N,2N), (N,3N)
       ASSUMED TO BE ISOTROPIC IN THE LAB SYSTEM.

MF=5   ENERGY DISTRIBUTIONS OF THE SECONDARY NEUTRONS
   MT=16,17 91  (N,2N), (N,3N) AND CONTINUUM INELASTIC
       EVAPORATION SPECTRA.
   MT=18  FISSION
       MAXWELL SPECTRUM.  THE TEMPERATURE PARAMETERS WERE ESTI-
       MATED FROM THE SYSTEMATICS OF HOWERTON-DOYAS/13/.
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MAT number = 9222

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 92-U -233 SAEI+      EVAL-MAR87 H.MATSUNOBU,Y.KIKUCHI,T.NAKAGAWA
                      DIST-SEP89 REV2-APR94
HISTORY
82-06 EVALUATION FOR JENDL-2 WAS MADE BY N. ASANO (SAEI),
      H. MATSUNOBU (SAEI) AND Y.KIKUCHI(JAERI).
87-03 RE-EVALUATION FOR JENDL-3 WAS MADE BY H.MATSUNOBU (SAEI)
      MAIN PART OF REVISION WAS THE CROSS SECTIONS ABOVE 10 KEV
      AND ANGULAR AND ENERGY DISTRIBUTIONS OF NEUTRONS.
        DATA WERE COMPILED BY T. NAKAGAWA (JAERI).
94-04 JENDL-3.2.
      RESONANCE PARAMETERS REEVALUATED BY H.DERRIEN (JAERI)/1/
      CROSS SECTIONS       REEVALUATED BY H.MATSUNOBU(SAEI)
      FISSION SPECTRUM     REEVALUATED BY T.OHSAWA(KINKI UNIV.)
        COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151); NEW ANALYSIS WITH SAMMY
      MF=3   ; ALL DATA EXCEPT FISSION CROSS SECTION BELOW 6.75
               MEV AND TOTAL CROSS SECTION
      MF=4   ; FOR INELASTIC SCATTERING
      (5,18)
     ***********************************************************


MF=1  GENERAL INFORMATION
  MT=451  COMMENTS AND DICTIONARY
  MT=452  NU-TOTAL
      SUM OF NU-D AND NU-P
  MT=455  NU-D
      BELOW 4 MEV
         NU-D = 0.0075094 + 4.627E-5*LN(E(MEV))
      BETWEEN 4 AND 20 MEV
         BASED ON THE DATA OF MASTERS ET AL. /2/ AND EVANS ET AL.
         /3/.
  MT=456  NU-P
      RENORMALIZATION WAS MADE TO 3.756 OF CF-252.
      BELOW 1 MEV
         NU-P = 2.486 + 0.1121*(E-DE),
         WHERE DE IS DIFFERENCE OF AVERAGE FRAGMENT KINETIC ENERGY
         BETWEEN INCIDENT AND THERMAL NEUTRON ENERGIES.  IT WAS
         TAKEN FROM DATA OF BOLDEMAN ET AL. /4/.
      BETWEEN 1 AND 2.73 MEV
         NU-P = 2.436 + 0.1279*E
      BETWEEN 2.73 AND 7.47 MEV
         NU-P = 2.327 + 0.1678*E
      ABOVE 7.47 MEV
         NU-P = 2.857 + 0.09689*E

MF=2  RESONANCE PARAMETERS
  MT=151
  A) RESOLVED RESONANCE REGION ( 1 EV TO 150 EV)
      RESOLVED RESONANCE PARAMETERS FOR THE REICH-MOORE FORMULA
      WERE OBTAINED BY USING SAMMY/5/.  DETAILS ARE GIVEN IN
      APPENDIX.
  B) UNRESOLVED RESONANCE REGION ( 0.15 KEV TO 30 KEV)
      PARAMETERS WERE DEDUCED WITH ASREP CODE /6/ SO AS TO
      REPRODUCE THE EVALUATED CROSS SECTIONS IN THIS ENERGY
      REGION.

     2200-M/S CROSS SECTIONS AND CALCULATED RES. INTEGRALS
                         2200 M/S      RES. INTEG.
           TOTAL         588.38 B          -
           ELASTIC        11.97 B          -
           FISSION       531.16 B         774 B
           CAPTURE        45.25 B         138 B

MF=3  NEUTRON CROSS SECTIONS
 SMOOTH PART (ABOVE 30 KEV)

  MT=1    TOTAL
     BASED ON THE DATA OF POENITZ /7,8/. BETWEEN 10 AND 48
     KEV, CROSS-SECTION CURVE CALCULATED WITH THE STATISTICAL-
     MODEL CODE CASTHY /9/ AND THE COUPLED-CHANNEL THEORY CODE
     ECIS /10/ WAS NORMALIZED AT 48 KEV.
  MT=2    ELASTIC
     OBTAINED BY SUBTRACTING NON-ELASTIC SCATTERING CROSS SECTION
     FROM THE TOTAL CROSS SECTION.
  MT=4 AND 51-64,91  INELASTIC SCATTERING
     CALCULATED WITH CASTHY /9/ AND ECIS /10/. COUPLED LEVELS WERE
     FIRST THREE LEVELS.  DEFORMED OMP RECOMMENDED BY HAOUAT ET
     AL. /11/, WAS SLIGHTLY MODIFIED SO AS TO REPRODUCE THE
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     EXPERIMENTAL DATA OF SMITH ET AL. /12/, AND SPHERICAL OMP WAS
     THE SAME AS THAT USED FOR JENDL-2.  IN THE ENERGY RANGE ABOVE
     8.25 MEV, THE CROSS SECTION WAS APPROXIMATED BY USING AN
     EXTPONENTIAL-TYPE FUCTION, BECAUSE THE CROSS SECTION CURVE
     OBTAINED BY CASTHY AND ECIS SHOWED LARGE FLUCTUATION.

      DEFORMED OMP
         V =46.4-0.3*E           , WS=3.5 +0.4*E , VSO=6.2 (MEV)
         R0=1.26                 , RS=1.26       , RSO=1.12 (FM)
         A0=0.63                 , B =0.52       , ASO=0.47 (FM)
         BETA-2=0.20, BETA-4=0.074
      SPHERICAL OMP
         V =41.8-0.20*E+0.008*E**2, WS=6.50-0.15*E, VSO=6.0 (MEV)
         R0=1.31                 , RS=1.36       , RSO=1.32 (FM)
         A0=0.57                 , B =0.44       , ASO=0.50 (FM)
                                   (DIR. W.S.)

     LEVEL SCHEME WAS TAKEN FROM REF. /13/.
             NO.      ENERGY(MEV)  SPIN-PARITY
             G.S.      0.0           5/2 +      *
              1        0.04035       7/2 +      *
              2        0.0922        9/2 +      *
              3        0.1551       11/2 +      *
              4        0.29882       5/2 -
              5        0.31191       3/2 +
              6        0.3208        7/2 -
              7        0.34047       5/2 +
              8        0.3537        9/2 -
              9        0.397        11/2 -
             10        0.39849       1/2 +
             11        0.41576       3/2 +
             12        0.5039        7/2 -
             13        0.5467        5/2 +
             14        0.5971        7/2 +
     ABOVE 0.6 MEV, ASSUMED TO BE OVERLAPPED. LEVELS WITH ASTERISK
     WERE COUPLED IN THE ECIS CALCULATION.

  MT=16,17  (N,2N) AND (N,3N)
     CALCULATED BY USING THE EGNASH-2 CODE /14/. THE (N,2N) CROSS
     SECTION WAS NORMALIZED TO FISSION-SPECTRUM-AVERAGED VALUE OF
     0.00408 B MEASURED BY KOBAYASHI ET AL./15/.  THE SAME
     NORMALIZATION FACTOR WAS ALSO APPLIED TO THE (N,3N) CROSS
     SECTION.
  MT=18   FISSION
     BASED ON THE EXPERIMENTAL DATA OF GWIN ET AL. /16/, CARLSON
     ET AL. /17/, MANABE ET AL. /18/, KANDA ET AL. /19/, IWASAKI
     ET AL. /20/, MEADOWS /21/, LISOWSKI ET AL./22/ AND THE
     FISSION CROSS SECTION OF U-235 OBTAINED BY THE SIMULTANEOUS
     EVALUATION /23/ AND MEASURED BY CARLSON ET AL./24/ BETWEEN
     13.25 AND 20 MEV.
  MT=102  CAPTURE
     IN THE ENERGY RANGE FROM 30 KEV TO 1 MEV, THE ALPHA VALUES
     MEASURED BY HOPKINS AND DIVEN /25/ WERE MULTIPLIED BY THE
     FISSION CROSS SECTION. IN THE HIGH ENERGY REGION, VALUES
     CALCULATED WITH CASTHY AND ECIS WERE NORMALIZED TO 0.0578 B
     AT 1 MEV.
  MT=251  MU-BAR
     CALCULATED WITH CASTHY AND ECIS.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2, 51-64 AND 91
     CALCULATED WITH CASTHY AND ECIS.
  MT=16,17 AND 18
     ASSUMED TO BE ISOTROPIC IN THE LAB SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,91
     CALCULATED WITH PEGASUS /26/.
  MT=18  FISSION SPECTRUM
     DISTRIBUTIONS WERE CALCULATED WITH THE MODIFIED MADLAND-NIX
     MODEL/27,28/.  THE COMPOUND NUCLEUS FORMATION CROSS SECTIONS
     FOR FISSION FRAGMENTS (FF) WERE CALCULATED USING BECCHETTI-
     GREENLEES POTENTIAL/29/.  UP TO 4TH-CHANCE-FISSION WERE
     CONSIDERED AT HIGH INCIDENT NEUTTRON ENERGIES.  THE IGNATYUK
     FORMULA/30/ WERE USED TO GENERATE THE LEVEL DENSITY
     PARAMETERS.
       PARAMETERS ADOPTED:
           TOTAL AVERAGE FF KINETIC ENERGY = 172.311-0.0212*E(MEV)
           AVERAGE ENERGY RELEASE          = 188.438 MEV
           AVERAGE MASS NUMBER OF LIGHT FF =  95
           AVERAGE MASS NUMBER OF HEAVY FF = 139
           LEVEL DENSITY OF THE LIGHT FF   =  9.999- 10.094
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LEVEL DENSITY OF THE HEAVY FF = 11.89 - 12.20
NOTE THAT THE PARAMETERS VARY WITH THE INCIDENT ENERGY
WITHIN THE INDICATED RANGE.
MT=455 DELAYED NEUTRONS
RECOMMENDATION BY SAPHIER ET AL. /31/ WAS ADOPTED.

MF=8 FISSION PRODUCT YIELDS
MT=454 FISSION PRODUCT YIELD DATA (INDEPENDENT)
MT=459 FISSION PRODUCT YIELD DATA (CUMULATIVE)
BOTH WERE TAKEN FROM JNDC FP DECAY DATA FILE VERSION 2 /32/.

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APPENDIX RESONANCE DATA ,JAERI DECEMBRE 1992

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THE REICH-MOORE R-MATRIX RESONANCE PARAMETERS WERE OBTAINED FROM SEQUENCIAL BAYESIAN FITS OF SELECTED EXPERIMENTAL TOTAL, FISSION AND CAPTURE CROSS SECTIONS PERFORMED WITH THE COMPUTING CODE SAMMY. THE SELECTED EXPERIMENTAL DATA WERE THE FOLLOWING:

1) TOTAL CROSS SECTIONS MEASURED BY PATTENDEN/1/, MOORE/2/, KOLAR/3/, HARVEY/4/;
2) FISSION CROSS SECTIONS MEASURED BY WESTON/5,6/, BLONS/7/, DERUYTER/8/, WAGEMANS/9/.
3) CAPTURE CROSS SECTIONS MEASURED BY WESTON/5,6/.

IN THE LOW ENERGY RANGE THE DATA OF PATTENDEN,MOORE,HARVEY, KOLAR, WESTON, DERUYTER AND WAGEMANS WERE CONSIDERED.IN THE ENERGY RANGE FROM 15 EV TO 150 EV, ONLY THE DATA FROM KOLAR, BLONS AND WESTON COULD BE ANALYSED OWING TO THE POOR RESOLUTION OF THE OTHER DATA. SOME OF THE DATA WERE RENORMALIZED TO THE AXTON STANDARD /10/ AT 0.0253 EV. THE FISSION CROSS SECTION MEASUREMENT OF WESTON /5/ AVAILABLE IN THE ENERGY RANGE ABOVE 1 EV WAS RENORMALISED TO THE DATA OF WAGEMANS/9/ OVER THE ENERGY RANGE FROM 1 EV TO 20 EV, RESULTING IN AN INCREASE OF THE CROSS SECTION BY 2.4% COMPARED TO THE ORIGINAL EXFOR FILE. THE FISSION CROSS SECTION MEASUREMENT OF BLONS AVAILABLE IN THE ENERGY RANGE ABOVE 15 EV WAS RENORMALIZED TO THE THE DATA OF WESTON OVER THE ENERGY RANGE FROM 15 EV TO 150 EV, RESULTING IN AN INCREASE OF THE CROSS SECTION BY 2.9% COMPARED TO THE DATA IN THE ORIGINAL EXFOR FILE. THE TOTAL CROSS SECTION OF KOLAR NEEDED A BACKGROUND CORRECTION OF (2.3-0.038E) BARN, E IN EV, IN THE ENERGY RANGE FROM 77 EV TO 150 EV, CORRESPONDING TO 0 TO 1.5% OF THE MEASURED TRANSMISSION. THESE RENORMALIZATIONS AND BACKGROUND CORRECTIONS WERE PERFORMED AFTER PRELIMINARY FITS OF THE DATA AVAILABLE FROM THE EXFOR FILE IN ORDER TO REALIZE A

CONSISTENCY OF +-2% AMONG THE CROSS SECTION OF THE EXPERIMENTAL DATA BASE. THE FINAL SAMMY FITS WERE PERFORMED WITHOUT RENORMALIZATION AND BACKGROUND CORRECTION PARAMETERS

THE TRANSMISSION DATA OF PATTENDEN, MOORE, HARVEY AND KOLAR ARE NOT AVAILABLE FROM THE EXFOR FILE AND WERE NOT REQUESTED FROM THE AUTHORS. THE SAMMY FITS WERE PERFORMED ON THE EXPERIMENTAL EFFECTIVE TOTAL CROSS SECTIONS USING THE SAMPLE THICKNESSES AND THE EXPERIMENTAL RESOLUTION TO CALCULATE THE THEORITICAL EFFECTIVE CROSS SECTIONS. ENOUGH INFORMATIONS WERE FOUND IN THE PUBLICATIONS BY THE AUTHORS TO ENSURE THE ACCURACY OF THE CALCULATIONS.

DUE TO THE HIGH RESOLUTION OF THE TRANSMISSION MEASUREMENTS OF KOLAR(100 M FLIGHT PATH) AND OF THE FISSION MEASUREMENTS OF BLONS (50 M FLIGHT PATH AND SAMPLE COOLED DOWN AT LIQUID NITROGEN TEMPERATURE) THE ANALYSIS COULD BE PERFORMED UP TO 150 EV NEUTRON ENERGY. THE HIGH RESOLUTION FISSION CROSS SECTION OF CAO/11/ WERE NOT INCLUDED IN THE EXPERIMENTAL DATA BASE OWING TO A SEVERE PROBLEM OF THE RENORMALIZATION OF THE DATA.

THE CAPTURE CROSS SECTIONS OF WESTON WERE INCLUDED IN THE FITS BELOW 30 EV ONLY. ABOVE 30 EV THE STATISTICAL ACCURACY OF THE DATA WAS TOO POOR AND THE TRY AND ERROR METHOD WAS USED IN A PRELIMINARY WORK TO OBTAIN THE CAPTURE WIDTH OF SOME STRONG CAPTURE RESONANCES. THE CAPTURE WIDTH OF THE OTHER RESONANCES WAS KEPT AT A CONSTANT VALUE OF 41 MEV CLOSE TO THE AVERAGE VALUE OBTAINED BY FITTING THE ENERGY RANGE BELOW 30 EV. SOME RESONANCES NOT PERTAINING TO 233U WERE DISCLOSED IN THE EXPERIMENTAL DATA AND WERE IDENTIFIED AS 195PT RESONANCES. THE EXPERIMENTAL DATA OF TABLE 2 WERE ROUGHLY CORRECTED FOR THESE RESONANCES.

THE VALUES OF THE CROSS SECTIONS OBTAINED BY AXTON AT 0.0253 EV WERE INCLUDED IN ALL THE EXPERIMENTAL DATA AVAILABLE IN THE THERMAL RANGE WITH THE SMALL ERROR BARS OBTAINED BY AXTON, IN ORDER TO ENSURE THE BEST AGREEMENT BETWEEN THE CALCULATED AND THE EVALUATED THERMAL VALUES. THE VALUES CALCULATED FROM THE RESONANCE PARAMETERS ARE THE FOLLOWINGS:

	CALCULATION (RESENDD 0.1% 300 K)	AXTON EVALUATION
FISSION	531.29 B	530.70+-1.34 B
CAPTURE	45.27 B	45.62+-0.70 B
SCATTERING	11.99 B	12.19+-0.67 B

TABLES 1 AND 2 SHOW THE AVERAGE CROSS SECTIONS CALCULATED FROM THE RESONANCE PARAMETERS COMPARED WITH THE AVERAGE EXPERIMENTAL DATA AND WITH AVERAGE JENDL-3, ENDF/B-VI AND JEF-2 DATA.

TABLE 1 FISSION CROSS SECTIONS

ENERGY RANGE(EV)	WAGEM	DERUY	WESTO	BLONS	CALCU	JENDL	ENDF6	JEF2
0.021-0.031	525.6	526.7	526.8		526.5	528.8	523.9	520.6
0.031-0.082	362.9	363.5	363.9		361.7	363.9	361.9	359.7
0.082-1.000	151.3	150.9	150.6		150.1	149.4	149.0	148.6
1.000-2.100	388.8	387.7	391.7		387.9	383.0	378.9	382.1
2.100-2.750	204.4	204.6	207.5		204.6	205.9	198.1	198.8
2.750-3.000	50.1	53.4	51.9		50.2	52.9	50.6	50.8
3.000-15.00	106.2	105.6	104.9		104.3	103.6	101.2	101.5
0.021-15.00	134.2	133.5	133.5		132.5	131.7	129.1	129.5
15.00-30.00			95.03	94.60	95.51	96.49	91.80	92.69
30.00-50.00			40.13	40.30	40.27	40.19	38.85	39.16
50.00-75.00			40.66	40.49	40.53	40.79	35.80	39.90
75.00-100.0			35.57	36.70	36.03	36.58	33.36	32.74
100.0-125.0			36.84	36.89	36.97	31.78	29.94	28.94
125.0-150.0			21.29	20.29	20.78	16.30	22.10	26.25
15.00-150.0			41.39	41.48	41.45	39.91	38.49	40.05

TABLE 2 CAPTURE CROSS SECTIONS

ENERGY RANGE(EV)	WESTON	CALCUL	JENDL3	ENDF6	JEF2.2
0.021-0.031	45.17	44.90	44.82	45.40	45.54

0.031-0.082	32.51	32.57	32.45	32.58	32.68
0.082-1.000	14.06	14.44	13.99	13.24	13.13
1.000-2.100	66.83	66.54	70.54	67.46	67.31
2.100-2.750	111.83	110.67	106.25	112.04	110.80
2.750-3.000	7.50	8.25	8.85	7.53	5.74
3.000-15.00	17.43	17.61	19.51	17.66	17.02
0.021-15.00	24.85	24.97	26.57	24.22	24.43
15.00-30.00	13.25	13.97	11.92	13.27	12.67
30.00-50.00	5.21	5.81	4.85	5.47	5.00
50.00-75.00	4.91	5.38	4.42	3.80	5.25
75.00-100.0	8.71	9.07	5.39	4.30	5.33
100.0-125.0	5.37	6.01	3.55	3.88	4.63
125.0-150.0	3.38	3.78	2.12	3.54	4.12
15.00-150.0	6.39	6.90	4.91	5.16	5.73

THE EXPERIMENTAL CAPTURE DATA OF WESTON WAS INCREASED BY A BACKGROUND CORRECTION ACCORDING TO THE EVALUATION OF REYNOLDS ET AL./12/ AND RENORMALIZED TO THE ORIGINAL VALUE OF WESTON IN THE ENERGY RANGE 1.0 EV TO 2.75 EV.

RESONANCE INTEGRAL FISSION

ENERGY RANGE	THIS WORK	JENDL-3	ENDF/B-6	JEF-2
0.5 EV-150 EV	710.34	710.53	691.08	697.18
150 EV-20 MEV		64.25	63.34	65.29
0.5 EV-20 MEV		774.79	754.43	762.47

RESONANCE INTEGRAL CAPTURE

ENERGY RANGE	THIS WORK	JENDL-3	ENDF/B-6	JEF-2
0.5 EV-150 EV	131.92	131.77	128.79	127.51
150 EV-20 MEV		6.65	7.58	7.24
0.5 EV-20 MEV		138.42	136.37	134.75

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MAT number = 9225

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 92-U -234 KAWASAKI   EVAL-MAR87 T.WATANABE
                      DIST-SEP89 REV2-JUL93
HISTORY
87-03 NEW EVALUATION FOR JENDL-3 WAS MADE BY T.WATANABE (KWASAKI
      HEAVY IND.)
87-06 COMPILATION WAS MADE BY T.NAKAGAWA (JAERI)
93-07 JENDL-3.2.
      MODIFIED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (1,452), (1,455), (1456)  NEW EVALUATION
      (3,2), (3,4), (3,51-91)   NEW LEVEL SCHEME ADOPTED.
     ***********************************************************


MF=1  GENERAL INFORMATION
  MT=451   DESCRIPTIVE DATA AND DICTIONARY
  MT=452   NUMBER OF NEUTRONS PER FISSION
      SUM OF MT=455 AND 456.
  MT=455   DELAYED NEUTRONS PER FISSION
      SYSTEMATICS OF TUTTLE/1/.  SIX GROUP DECAY CONSTANTS WERE
      ADOPTED FROM BRADY ET AL./2/
  MT=456   PROMPT NEUTRONS PER FISSION
      BASED ON THE EXPERIMENTAL DATA BY MATHER ET AL./3/ NU-P OF
      CF-252 SPONTANEOUS FISSION WAS ASSUMED TO BE 3.756.

MF=2 RESONANCE PARAMETERS
  MT=251   RESONANCE PARAMETERS            ; 1.0E-5 EV - 50 KEV
      RESOLVED RESONANCES FOR MLBW FORMULA : 1.0E-5 EV - 1.5 KEV
         PARAMETERS OF REF./4/ WERE ADOPTED AFTER MODIFICATION OF
         AN AVERAGE RADIATIVE WIDTH TO 0.026 EV/5/.  A NEGATIVE
         LEVEL WAS ADDED AT -2.06 EV SO AS TO REPRODUCE THE CROSS
         SECTIONS AT 0.0253 EV/5/.
             TOTAL   = 119.1 +- 1.3 B
             ELASTIC = 19.6 +- 1.0 B
             CAPTURE = 99.8 +- 1.3 B

      UNRESOLVED RESONANCES                 : 1.5 KEV - 50 KEV
         THE FOLLOWING PARAMETERS WERE GIVEN.
           <WG> = 0.026 EV/2/, <WF> = 0.0 EV, D-OBS = 10.6 EV/2/,
            S-0 = 0.96E-4 (CALCULATED WITH ECIS/6/),
            S-1 = 1.197E-4 (ADJUSTED TO THE TOTAL CROSS SECTION
                            CALCULATED WITH ECIS/6/),
            R    = 9.70 FM (ADJUSTED TO THE TOTAL CROSS SECTION AT
                            50 KEV).

      CALCULATED 2200M/S CROSS SECTIONS AND RESONANCE INTEGRALS.
                       2200 M/S        RESONANCE INTEGRAL
           TOTAL        119.2  B        ---
           ELASTIC       19.41 B        ---
           FISSION        6.22 MB      6.72 B
           CAPTURE       99.75 B       632  B

MF=3  NEUTRON CROSS SECTIONS
      BELOW 50 KEV, RESONANCE PARAMETERS WERE EVALUATED.
      BACKGROUND CROSS SECTIONS FOR THE FISSION WERE GIVEN IN THE
      UNRESOLVED RESONANCE REGION.

  MT=1,2,4,51-69,91,102 TOTAL, ELASTIC AND INELASTIC SCATTERING,
                        AND CAPTURE
      CALCULATED WITH COUPLED-CHANNEL CODE ECIS/6/ AND SPHERICAL
      OPTICAL AND STATISTICAL MODEL CODE CASTHY/7/.

      THE DEFORMED OPTICAL POTENTIAL PARAMETERS OF LAGRANGE/8/
      WERE ADOPTED FOR THE ECIS CALCULATION.

             V  = 46.42 - 0.3 * EN,      R0 = 1.26,  A0 = 0.63
             WS = 3.72  + 0.4 * EN,      RS = 1.26,  B  = 0.52
                    EN UP TO 10 MEV
                = 7.72
                    EN ABOVE 10 MEV
             VSO   = 6.2                 RSO= 1.12   ASO= 0.47
             BETA2 = 0.194
             BETA4 = 0.071

      THE FOLLOWING SPHERICAL OPTICAL POTENTIAL PARAMETERS FOR THE
      CASTHY CALCULATION WERE DETERMINED SO AS TO REPRODUCE THE
      TOTAL CROSS SECTION CALCULATED WITH ECIS BY USING THE ABOVE
      OMP.

             V  = 41.49 - 0.1359 * EN
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WS = 9.284 - 0.2086 * EN+ 0.03225 * EN**2
(DERIVATIVE WOODS-SAXON FORM)
VSO= 4.248,
R = 1.315, RS = 1.381, RSO= 1.15
A0 = 0.528, B = 0.372, ASO= 0.597

THE LEVEL SCHEME WAS TAKEN FROM REF./9/.

NO.	ENERGY(MEV)	SPIN-PARITY	COUPLED LVL
G.S	0.0	0 +	*
1	0.04348	2 +	*
2	0.14334	4 +	*
3	0.29606	6 +	*
4	0.49702	8 +	*
5	0.7412	10 +	*
6	0.78628	1 -	
7	0.80989	0 +	
8	0.84930	3 -	
9	0.85172	2 +	
10	0.92672	2 +	
11	0.94785	4 +	
12	0.9626	5 -	
13	0.9691	3 +	
14	0.9895	2 -	
15	1.0236	4 +	
16	1.0238	3 -	
17	1.0445	0 +	
18	1.0854	2 +	
19	1.0916	0 +	

CONTINUUM LEVELS WERE ASSUMED ABOVE 1.126 MEV

LEVEL DENSITY PARAMETERS WERE EVALUATED USING D-OBS AND EXCITED LEVEL DATA/2,6/.

	A(1/MEV)	T(MEV)	EX(MEV)	SIG**2(0)
92-U-234	29.349	0.4058	4.769	16.872
92-U-235	31.415	0.3914	4.231	14.378

THE GAMMA-RAY STRENGTH FUNCTION (=84.6E-4) WAS DETERMINED BY NORMALIZING THE CAPTURE CROSS SECTION TO 0.46535 B AT 50 KEV WHICH WAS CALCULATED FROM ABOVE-MENTIONED UNRESOLVED RESONANCE PARAMETERS.

MT=16,17 (N,2N) AND (N,3N)
JENDL-2 DATA CALCULATED WITH THE EVAPORATION MODEL WERE RENORMALIZED SO THAT THEY MIGHT BE CONSISTENT WITH THE FISSION AND COMPOUND FORMATION CROSS SECTIONS CALCULATED WITH ECIS AND CASTHY.

MT=18 FISSION
EXPERIMENTAL DATA /10,11,12/ OF FISSION CROSS SECTION RATIO TO U-235 WERE EVALUATED. FISSION CROSS SECTION WAS OBTAINED BY MULTIPLYING THE U-235 FISSION CROSS SECTION/13/ TO THE RATIO.

MT=251 MU-L BAR
CALCULATED WITH ECIS AND CASTHY.

MF=4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=2,51-69,91 CALCULATED WITH ECIS AND CASTHY
MT=16,17,18 ASSUMED TO BE ISOTROPIC IN THE LAB. SYSTEM.

MF=5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=16,17,91 TABLE TYPE DATA WERE GIVEN
SPECTRA WERE CALCULATED WITH PREEQUILIBRIUM AND MULTI-STEP EVAPORATION MODEL CODE PEGASUS /14/
MT=18
CALCULATED WITH THE FORMULA OF MADLAND AND NIX /15/. CONSTANT COMPOUND NUCLEUS FORMATION CROSS SECTION MODEL WAS ADOPTED.

TOTAL AVERAGE FF KINETIC ENERGY = 171.09 MEV
AVERAGE ENERGY RELEASE = 187.976 MEV
AVERAGE MASS NUMBER OF LIGHT FF = 95
AVERAGE MASS NUMBER OF HEAVY FF = 140
LEVEL DENSITY PARAMETER = A/10.0

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MAT number = 9228
 92-U -235 SAEI+      EVAL-MAR87 H.MATSUNOBU,K.HIDA,T.NAKAGAWA+
                      DIST-SEP89 REV2-AUG93
HISTORY
87-03 NEWLY EVALUATED FOR JENDL-3 BY THE FOLLOWING EVALUATORS.
       K.HIDA (NAIG)                GAMMA-RAY PRODUCTION DATA
       Y.NAKAJIMA (JAERI)           RESOLVED RESONANCES
       T.NAKAGAWA (JAERI)           UNRESOLVED RESONANCES
       H.MATSUNOBU (SAEI)           OTHER QUANTITIES
88-08 DATA WERE PARTLY MODIFIED TO FINAL JENDL-3 DATA.
       NU-BAR, UNRESOLVED RESONANCE PARAMETERS.
89-02 FP YIELDS WERE REPLACED WITH JNDC FP DECAY FILE VERSION-2.
  DATA WERE COMPILED IN ENDF-5 FORMAT BY T.NAKAGAWA (JAERI)
93-08 JENDL-3.2.
       H.MATSUNOBU (SAEI): NU-P, FISSION CROSS SECTION
       T.OHSAWA (KINKI UNIV.): FISSION SPECTRUM
       Y.KIKUCHI AND T.NAKAGAWA (JAERI): RESONANCE PARAMETERS
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (1,452), (1,456)    NEW EVALUATION OF (1,456)
      (2,151)             RESOLVED AND UNRESOLVED RESONANCE
                          PARAMETERS UP TO 30 KEV
      (3,2), (3,18)       ABOVE 13 MEV
      (5,18)              WITH MODIFIED MADLAND-NIX FORMULA
     ***********************************************************


MF=1  GENERAL INFORMATION
  MT=451  COMMENTS AND DICTIONARY
  MT=452  TOTAL NUMBER OF NEUTRONS PER FISSION
      SUM OF NU-P (MT=456) AND NU-D (MT=455).
  MT=455  DELAYED NEUTRON DATA
      EVALUATED ON THE BASIS OF THE EXPERIMENTAL DATA BY KEEPIN ET
      AL. /1/, KEEPIN /2/, MASTERS ET AL. /3/, CONANT AND PALMEDO
      /4/, EVANS AND THORPE /5/, COX /6/, BESANT ET AL. /7/ AND
      SYNETOS AND WILLIAMS /8/.
  MT=456  NUMBER OF PROMPT NEUTRONS
      EVALUATED ON THE BASIS OF THE FOLLOWING EXPERIMENTAL DATA:
          BELOW 60 EV          GWIN ET AL./9/
          20 EV   - 500 EV     GWIN ET AL./10/
          0.5 KEV - 5.15 MEV   GWIN ET AL./11/
          5.15 MEV- 15 MEV     FREHAUT ET AL./12/
          15 MEV  - 20 MEV     FREHAUT ET AL./13/, HOWE /14/
      THE STANDARD VALUE OF 3.756 OF CF-252 NU-P WAS USED IN THE
      PRESENT EVALUATION.

MF=2  RESONANCE PARAMETERS
  MT=151
  1) RESOLVED RESONANCES : BELOW 500 EV
      REICH-MOORE PARAMETERS IN ENDF/B-VI/15,16/ WAS ADOPTED.
      AVERAGE CAPTURE WIDTH OF 0.035 EV WAS INCREASED TO 0.0385 EV
      IN THE ENERGY REGION ABOVE 300 EV.

  2) UNRESOLVED RESONANCE PARAMETERS : 500 EV - 30 KEV
      THE EVALUATED TOTAL, CAPTURE AND FISSION CROSS SECTIONS WERE
      FITTED BY ADJUSTING S0, S1 AND FISSION WIDTH  THE FISSION
      CROSS SECTION WAS BASED ON THE EXPERIMENTAL DATA OF WESTON
      AND TODD /17/.  THE CAPTURE CROSS SECTION WAS CALCULATED AS
      (SIG-F)*ALPHA, WHERE ALPHA VALUES WERE DETERMINED FROM
      EXPERIMENTAL DATA OF MURADYAN ET AL. /18/ THE TOTAL CROSS
      SECTION WAS EVALUATED ON THE BASIS OF THE EXPERIMENTAL DATA
      BY UTTLEY ET AL. /19/, BOECKOFF ET AL. /20/, MICHAUDON ET
      AL. /21/ AND DERRIEN /22/

      2200-M/S CROSS SECTIONS AND CALCULATED RES. INTEGRALS.
                     2200 M/S        RES. INTEG.
         ELASTIC      15.03 B            -
         FISSION     584.4  B           279 B
         CAPTURE      98.81 B           134 B
         TOTAL       698.2  B            -

MF=3  NEUTRON CROSS SECTIONS
  BELOW 30 KEV: NO BACKGROUND DATA FOR RESONANCE PARAMETERS ARE
                GIVEN.
  ABOVE 30 KEV: DATA WERE EVALUATED AS FOLLOWS.
  MT=1    TOTAL
      EVALUATED ON THE BASIS OF THE EXPERIMENTAL DATA BY UTTLEY ET
      AL. /19/, BOECKOFF ET AL. /20/, SCHWARTZ ET AL. /23/, GREEN
      ET AL. /24/, FOSTER AND GLASGOW /25/, POENITZ ET AL.  /26/,
      AND POENITZ AND WHALEN /27/.
  MT=2    ELASTIC SCATTERING
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     EVALUATED ON THE BASIS OF THE EXPERIMENTAL DATA BY SMITH
     /28/, SMITH AND WHALEN /29/ AND KNITTER ET AL. /30/ IN THE
     ENERGY RANGE FROM 0.3 TO 2.3 MEV.  IN THE REMAINING ENERGY
     RANGE IT WAS DERIVED BY SUBTRACTING SUM OF PARTIAL CROSS
     SECTIONS FROM TOTAL CROSS SECTION.
MT=4,51-79,91,251 INELASTIC SCATTERING CROSS SECTION AND MU-BAR
     EVALUATED ON THE BASIS OF EXPERIMENTAL DATA AND CALCULATION
     WITH OPTICAL AND STATISTICAL MODELS, AND COUPLED CHANNEL
     THEORY TAKING INTO ACCOUNT OF DEFORMATION OF NUCLEUS.  THE
     CALCULATED INELASTIC SCATTERING CROSS SECTIONS WERE
     DECREASED BY FACTOR OF 0.9 BELOW ABOUT 2 MEV SO AS TO BE IN
     AGREEMENT WITH SMITH ET AL. /31/.

     DEFORMED OPTICAL POTENTIAL PARAMETERS WERE ADOPTED FROM THE
     RECOMMENDATION BY HAOUAT ET AL. /32/.
        V  = 46.4  - 0.3*EN,  WS = 3.3 + 0.4*EN, VSO= 6.2  (MEV)
        R0 = 1,26,            RS = 1.26,         RSO= 1.12  (FM)
        A0 = 0.63,            B  = 0.52,         ASO= 0.47  (FM)
        BETA-2 = 0.22,    BETA-4 = 0.08
     THE SPHERICAL OPTICAL POTENTIAL PARAMETERS WERE OBTAINED BY
     FITTING THE EXPERIMENTAL DATA OF THE TOTAL CROSS SECTION.
        V  = 40.90 - 0.04*EN, WS = 6.5 + 0.25*EN,VSO= 7.0  (MEV)
        R0 = 1.312,           RS = 1.375,        RSO= 1.320 (FM)
        A  = 0.490,           B  = 0.454,        A0 = 0.470 (FM)

     STATISTICAL MODEL CALCULATION WITH CASTHY CODE /33/.
        COMPETING PROCESSES : FISSION (N,2N), (N,3N), (N,4N).
        LEVEL FLUCTUATION WAS CONSIDERED.

     THE LEVEL SCHEME TAKEN FROM REFS./34,35/.
              NO.     ENERGY(KEV)   SPIN-PARITY
              G.S.        0.0         7/2 -
               1          0.075       1/2 +
               2         13.038       3/2 +
               3         46.347       9/2 -
               4         51.697       5/2 +
               5         81.732       7/2 +
               6        103.2        11/2 -
               7        129.292       5/2 +
               8        150.4         9/2 +
               9        170.7        13/2 -
              10        171.378       7/2 +
              11        197.1        11/2 +
              12        225.40        9/2 +
              13        249.1        15/2 -
              14        291.1        11/2 +
              15        294.7        13/2 +
              16        332.818       5/2 +
              17        338.8        17/2 -
              18        357.2        15/2 +
              19        367.05        7/2 +
              20        368.8        13/2 +
              21        393.184       3/2 +
              22        414.8         9/2 +
              23        426.71        5/2 +
              24        445.7         7/2 +
              25        474.27        7/2 +
              26        510.0         9/2 +
              27        533.2         9/2 +
              28        607.7        11/2 +
              29        633.04        5/2 -
     CONTINUUM LEVELS ASSUMED ABOVE 650 KEV.
     THE LEVEL DENSITY PARAMETERS : GILBERT AND CAMERON /36/.

MT=16,17,37 (N,2N), (N,3N), (N,4N)
     EVALUATED ON THE BASIS OF THE FOLLOWING EXPERIMENTAL DATA
     AND CALCULATION WITH EVAPORATION MODEL.
        (N,2N)             : FREHAUT ET AL. /37/
        (N,3N) AND (N,4N) : VEESER AND ARTHUR /38/
MT=18   FISSION
     DERIVED WITH SIMULTANEOUS EVALUATION/47/ ON THE BASIS OF THE
     CAPTURE CROSS SECTIONS OF AU-197 AND U-238, THE FISSION
     CROSS SECTIONS OF U-235, -238, PU-239, -240 AND -241 IN THE
     ENERGY RANGE FROM 50 KEV TO 20 MEV.  RESULTS WERE ADOPTED IN
     THE ENERGY RANGE UP TO 13 MEV.  EXPERIMENTAL DATA OF U-235
     CONSIDERED IN THIS EVALUATION ARE AS FOLLOWS:
        PEREZ ET AL. /39/, POENITZ /40,41/, CZIRR AND SIDHU
        /42,43,44/, SZABO AND MARQUETTE /45/, BARTON ET AL.
        /46/, CANCE AND GRENIER /47,48/, CARLSON AND PATRICK
        /49/, KARI /50/, ADAMOV ET AL. /51/, ARLT ET AL. /52,
        53/, WASSON ET AL. /54,55/, LI ET AL. /56/, MAHDAVI ET
        AL. /57/, CARLSON AND BEHRENS /58/, CORVI ET AL. /59/,
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         DUSHIN ET AL. /60/ AND WESTON AND TODD /17/.
      ABOVE 13 MEV, BASED ON THE EXPERIMENTAL DATA OF CARLSON ET
      AL./61/.
  MT=102  CAPTURE
      DERIVED FROM THE EVALUATED ALPHA VALUE AND FISSION CROSS
      SECTION BELOW 1 MEV.  CALCULATED WITH CASTHY ABOVE 1 MEV.

      ALPHA VALUE WAS EVALUATED ON THE BASIS OF THE EXPERIMENTAL
      DATA BY HOPKINS AND DIVEN /62/, MURADYAN /18/ AND CORVI ET
      AL. /59/

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2, 51-79, 91      CALCULATED WITH CASTHY AND ECIS CODES.
  MT=16,17,18,37       ISOTROPIC IN THE LAB SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,37,91
      CALCULATED WITH PEGASUS/63/ ON THE BASIS OF PREEQUILIBRIUM
      AND MULTI-STEP EVAPORATION MODEL.
  MT=18
     DISTRIBUTIONS WERE CALCULATED WITH THE MODIFIED MADLAND-NIX
     MODEL/64,65/.  THE COMPOUND NUCLEUS FORMATION CROSS SECTIONS
     FOR FISSION FRAGMENTS (FF) WERE CALCULATED USING BECCHETTI-
     GREENLEES POTENTIAL/66/.  UP TO 4TH-CHANCE-FISSION WERE
     CONSIDERED AT HIGH INCIDENT NEUTTRON ENERGIES.  THE IGNATYUK
     FORMULA/67/ WERE USED TO GENERATE THE LEVEL DENSITY PARAME-
     TERS.
       PARAMETERS ADOPTED:
           TOTAL AVERAGE FF KINETIC ENERGY = 169.9 - 171.8 MEV
           AVERAGE ENERGY RELEASE          = 185.896 MEV
           AVERAGE MASS NUMBER OF LIGHT FF =  96
           AVERAGE MASS NUMBER OF HEAVY FF = 140
           LEVEL DENSITY OF THE LIGHT FF   =  9.76 -  9.80
           LEVEL DENSITY OF THE HEAVY FF   = 11.34 - 11.48
           RATIO OF NUCLEAR TEMPERATURE
                     FOR LIGHT TO HEAVY FF = 0.9 - 1.05
       NOTE THAT THE PARAMETERS VARY WITH THE INCIDENT ENERGY
       WITHIN THE INDICATED RANGE.
  MT=455
      TAKEN FROM SAPHIER ET AL. /68/

MF=8  FISSION PRODUCT YIELD DATA
  MT=454 AND 459
      BOTH WERE TAKEN FROM JNDC FP DECAY FILE VERSION-2 /69/.

MF=12  PHOTON PRODUCTION MULTIPLICITIES (OPTION 1)
       GIVEN FOR THE FOLLOWING SECTIONS BELOW 369.579 KEV
  MT=18    FISSION
      THE THERMAL NEUTRON-INDUCED FISSION GAMMA SPECTRUM
      MEASURED BY VERBINSKI /70/ WAS ADOPTED.
  MT=51-69 INELASTIC SCATTERING
      THE PHOTON BRANCHING DATA TAKEN FROM /35/ WERE CONVERTED
      TO THE PHOTON MULTIPLICITIES.
  MT=102   CAPTURE
      CALCULATED WITH GNASH /71/, WHERE THE PYGMY RESONANCE
      WAS INTRODUCED /72/.

MF=13  PHOTON PRODUCTION CROSS SECTIONS
    MT=3   NON-ELASTIC
      CALCULATED WITH GNASH /71/ ABOVE 369.579 KEV.
      VERBINSKI'S DATA /70/ WERE USED UP TO 20 MEV.

MF=14  PHOTON ANGULAR DISTRIBUTIONS
    MT=3,18,51-69,102
      ISOTROPIC DISTRIBUTIONS WERE ASSUMED.

MF=15  CONTINUOUS PHOTON ENERGY SPECTRA
    MT=3,102
      CALCULATED WITH GNASH /71/
    MT=18
      EXPERIMENTAL DATA BY VERBINSKI /70/ WERE ADOPTED.

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MAT number = 9231
 92-U -236 NAIG       EVAL-MAR88 T.YOSHIDA
                      DIST-SEP89 REV2-DEC93
HISTORY
79-03 NEW EVALUATION FOR JENDL-2 WAS MADE BY T.YOSHIDA(NAIG).
86-12 JENDL-2 DATA WERE CRITICALLY REVIEWED.
88-03 JENDL-2 DATA WERE REVISED TO MAKE JENDL-3 ON THE BASIS
      OF THE 86-12 REVIEW.  NEW RUSSIAN MEASUREMENTS (1982- 1986)
      WERE FULLY ADOPTED, RESULTANTLY LEADING TO A NEARLY 30
      PER-CENT REDUCTION OF CAPTURE CROSS-SECTION ABOVE 1.5 KEV.
      SUB-THRESHOLD FISSION CURVE WAS INTRODUCED BETWEEN 1.5 KEV
      AND 700 KEV.  UNKNOWN GAMMA-F WAS ASSUMED TO BE 0.354
      MILLI-EV.
  DATA WERE COMPILED BY T.NAKAGAWA (JAERI).
90-07 FP YIELD DATA WERE MODIFIED.
90-10 MF=5, MT=16,17,91: SPECTRA AT THRESHOLD ENERGIES WERE
      MODIFIED.
93-12 JENDL-3.2.
      MODIFIED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (1,452), (1,455), (1,456)
     ***********************************************************


MF=1  GENERAL INFORMATION
  MT=451  DESCRIPTIVE DATA AND DICTIONARY
  MT=452  NUMBER OF NEUTRONS PER FISSION
     SUM OF MT'S 455 AND 456.
  MT=455  DELAYED NEUTRONS PER FISSION
     SIX GROUP DECAY CONSTANTS WERE ADOPTED FROM BRADY ET AL./1/
     NU-D BELOW 6 MEV WAS ADOPTED FROM GUDKOV ET AL./2/, AND THAT
     ABOVE 7 MEV FROM BOBKOV ET AL./3/, RESPECTIVELY.
  MT=456  PROMPT NEUTRONS PER FISSION
     TAKEN FROM MALINOVSKII'S PAPER /4/.  ABOVE 5.9 MEV, THEIR
     RECOMMENDATION WAS EXTRAPOLATED.

MF=2 MT=151 RESONANCE PARAMETERS
  RESOLVED RESONANCES FOR MLBW FORMULA : 1.0E-5 EV TO 1.5 KEV
     RES. ENERGIES AND GAM-N(FOR GAM-N GREATER THAN 0.1*GAM-G)
                                              : CARRARO /5/
     GAM-N (FOR GAM-N SMALLER THAN 0.1*GAM-G) : MEWISSEN /6/
     GAM-G : MEWISSEN /6/, WHEN NOT GIVEN, MEAN VALUE WAS TAKEN.
     GAM-F : THEOBALD /7/.
        AVERAGE GAM-G = 23.0 MILLI-EV
        AVERAGE GAM-F = 0.354 MILLI-EV
     A NEGATIVE RESONANCE WAS INTRODUCED TO REPRODUCE THE 2200-
     M/S CAPTURE CROSS SECTION OF (5.11+-0.21) BARNS RECOMMENDED
     IN BNL-325 4TH EDITION.
  UNRESOLVED RESONANCES : 1.5 KEV TO 40 KEV
     PARAMETERS WERE DETERMINED TO REPRODUCE TOTAL AND CAPTURE
     CROSS SECTIONS CALCULATED WITH CASTHY AND EVALUATED FISSION
     CROSS SECTION. OBTAINED PARAMETERS ARE:
        S0 = 0.906E-4, S1 = ENERGY DEPENDENT (1.8E-4 - 2.7E-4)
        GAM-G = 0.023 EV, GAM-F = ENERGY DEPENDENT
        R = 9.36 FM, D-OBS = ENERGY DEPENDENT (14.66 - 13.57 EV)

     CALCULATED 2200-M/S CROSS SECTIONS AND RES. INTEGRALS
                     2200-M/SEC       RES. INTEG.
         TOTAL       13.69   B           -
         ELASTIC      8.337  B           -
         FISSION      0.0613 B          7.77 B
         CAPTURE      5.295  B        346.   B

MF=3  NEUTRON CROSS SECTIONS
  BELOW 1.5 KEV, ALL BACKGROUND CROSS SECTIONS ARE ZERO.
  ABOVE 1.5 KEV, DATA WERE EVALUATED AS FOLLOWS. IN THE ENERGY
  RANGE FROM 1.5 TO 40 KEV, UNRESOLVED RESONANCE PARAMETERS WERE
  EVALUATED AND BACKGROUND CROSS SECTION WAS GIVEN TO ELASTIC
  SCATTERING.

  MT=1,2,4,51-79,91,102,251  SIG-T,SIG-EL,SIG-IN,SIG-C,MU-BAR
     COUPLED CHANNEL AND STATISTICAL MODEL CALCULATIONS WERE MADE
     WITH ECIS /8/ AND CASTHY CODES /9/, RESPECTIVELY.
     THE DEFORMED OPTICAL POTENTIAL PARAMETERS AFTER HAOUAT AND
     LAGRANGE /10/:
        VR =49.8 - 16*SY - 0.3*EN                     (MEV),
        WS = 5.3 -  8*SY + 0.4*EN  (EN .LT. 10 MEV)  (MEV),
           = 9.3 -  8*SY           (EN .GE. 10 MEV)  (MEV),
        VSO= 6.2                                      (MEV),
             WHERE SY=(N-Z)/A
        R=1.26, RS=1.26, RSO=1.12                     (FM),
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      A=0.63, AS=0.52, ASO=0.47                        (FM).
   THE SPHERICAL OPTICAL POTENTIAL PARAMETERS FOR THE STATISTI-
   CAL MODEL CALCULATION WITH CASTHY:
      VR =40.8 - 0.05*EN,                             (MEV),
      WS = 6.5 + 0.15*EN                              (MEV),
      VSO= 7.0                                        (MEV),
      R=1.32, RS=1.38, RSO=1.32                        (FM),
      A=0.47, AS=0.47, ASO=0.47                        (FM).
   COMPETING PROCESSES : FISSION, (N,2N) AND (N,3N)
   LEVEL FLUCTUATION WAS CONSIDERED. THE GAMMA-RAY STRENGTH
   FUNCTION WAS DETERMINED SO THAT THE CALCULATED CAPTURE CROSS
   SECTION REPRODUCED THE MEASURED VALUE OF 0.85 BARNS /11/
   AROUND 10 KEV.
   THE LEVEL SCHEME TAKEN FROM REF. /12/.
      NO. ENERGY(MEV)  J-PARITY   NO. ENERGY(MEV)  J-PARITY
      GS   0.0          0 +        1   0.04524      2 +
       2   0.14948      4 +        3   0.30979      6 +
       4   0.52225      8 +        5   0.68757      1 -
       6   0.7442       3 -        7   0.7828      10 +
       8   0.8476       5 -        9   0.91916      0 +
      10   0.9581       2 +       11   0.9604       2 +
      12   0.9670       1 -       13   0.9880       2 -
      14   1.0014       3 +       15   1.0020       7 -
      16   1.0356       3 -       17   1.0512       4 +
      18   1.0529       4 -       19   1.0587       4 +
      20   1.0661       3 +       21   1.0700       4 -
      22   1.0862      12 +       23   1.0938       2 +
      24   1.1044       5 -       25   1.1110       2 -
      26   1.1267       5 +       27   1.1470       3 +
      28   1.1494       3 -       29   1.1640       6 -
      CONTINUUM LEVELS ASSUMED ABOVE 1.17 MEV.
   THE GROUND STATE, 1-ST AND 2-ND EXCITED LEVELS WERE COUPLED
   IN THE ECIS CALCULATION.

 MT=16,17  (N,2N) AND (N,3N)
   CALCULATED WITH THE PEGASUS CODE /13/.
 MT=18   FISSION
   EVALUATED ON THE BASIS OF MEASURED DATA OF U-236/U-235
   /14,15/.  TO GET ABSOLUTE VALUE MATSUNOBU'S EVALUATION /16/
   FOR U-235(N,F) WAS EMPLOYED.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=2,51,52     CALCULATED WITH ECIS AND CASTHY
 MT=53-79,91    CALCULATED WITH CASTHY.
 MT=16,17,18    ISOTROPIC DISTRIBUTION IN THE LAB. SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
 MT=16,17,91    CALCULATED WITH PEGASUS.
 MT=18          MAXWELLIAN FISSION SPECTRUM.  TEMPERATURE WAS
                ESTIMATED FROM Z**2/A VALUES /17/.

MF=8  FISSION PRODUCT YIELDS DATA
 MT=454  INDEPENDENT YIELDS
 MT=459  CUMULATIVE YIELDS
   BOTH WERE TAKEN FROM JNDC FP DECAY DATA FILE VERSION-2/18/.
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MAT number = 9234

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 92-U -237 JAERI      EVAL-MAR93 T.NAKAGAWA
                      DIST-MAR94
HISTORY
93-03  NEW EVALUATION WAS MADE FOR JENDL-3.2.

MF=1  GENERAL INFORMATION
  MT=451  DESCRIPTIVE DATA AND DICTIONARY
  MT=452  TOTAL NUMBER OF NEUTRONS PER FISSION
      SUM OF NU-P (MT=456) AND NU-D (MT=455).
  MT=455  DELAYED NEUTRON DATA
      DETERMINED FROM SYSTEMATICS BY TUTTLE/1/, BENEDETTI/2/ AND
      WALDO ET AL./3/  DECAY CONSTANTS WERE TAKEN FROM THE EVALU-
      ATION OF BRADY AND ENGLAND/4/.
  MT=456  NUMBER OF PROMPT NEUTRONS
      HOWERTON'S SYSTEMATICS/5/.

MF=2  RESONANCE PARAMETERS
  MT=151
   1) RESOLVED RESONANCE PARAMETERS: MLBW (1.0E-5 - 200 EV)
      BELOW 45 EV, HYPOTHETICAL RESONANCES WERE GENERATED FROM
      FISSION WIDTH OF 0.004 EV, S0 OF 1.0E-4 AND LEVEL SPACING OF
      3.5 EV, AND ADJUSTED TO REPRODUCE THERMAL CROSS SECTIONS.
      ABOVE 46 EV, PARAMETERS WERE ESTIMATED FROM FISSION-AREA
      DATA MEASURED BY MCNALLY ET AL./6/
   2) UNRESOLVED RESONANCE PARAMETERS: 200 EV - 30 KEV
      OBTAINED BY FITTING TO CAPTURE AND FISSION CROSS SECTIONS
      WITH ASREP/7/.
         S0 AND S2 = (0.97 - 1.02)E-4, S1 = (1.95 - 2.04)E-4,
         GAMMA-F = (0.006 - 0.070) EV, GAMMA-G = 0.035 EV
         R = 9.668 FM

      CALCULATED THERMAL CROSS SECTIONS AND RES. INTEGRAL (BARNS)
                     0.0253 EV      RESONANCE INTEGRAL
        TOTAL         478.5                -
        ELASTIC        24.39               -
        FISSION         1.70             48.7
        CAPTURE       452.4            1080

MF=3  NEUTRON CROSS SECTIONS
      BELOW 200 EV, CROSS SECTIONS WERE REPRESENTED WITH RESOLVED
      RESONANCE PARAMETERS. ABOVE 200 EV, THEY WERE EVALUATED AS
      FOLLOWS, AND THE UNRESOLVED RESONANCE PARAMETERS WERE GIVEN
      SO AS TO REPRODUCE THE CROSS SECTIONS IN THE ENERGY RANGE
      FROM 200 EV TO 30 KEV.

  MT= 1     TOTAL CROSS SECTION
      CALCULATED FROM THE OPTICAL MODEL WITH CASTHY/8/.
      PARAMETERS ARE LISTED IN TABLE 1.

  MT= 2     ELASTIC SCATTERING CROSS SECTION
      TOTAL - SUM OF PARTIAL CROSS SECTIONS

  MT= 16, 17  (N,2N) AND (N,3N) CROSS SECTIONS
      CALCULATED FROM A FORMULA GIVEN BY SAGEV AND CANER/9/.
      THE REACTION CROSS SECTIONS CALCULATED WITH CASTHY WAS
      ADOPTED AS THE NON-ELASTIC SCATTERING CROSS SECTION.

  MT= 18    FISSION CROSS SECTION
      CROSS SECTION OF 2.5 B AT 200 EV WAS ASSUMED FROM THE DATA
      OF MCNALLY ET AL./6/  CROSS SECTION AT 100 KEV WAS ASSUMED
      TO BE 0.6 B.  ABOVE 5 MEV, A SIMPLE FORMULA BY BYCHKOV ET
      AL./9/ WAS USED.  EXPERIMENTAL DATA OF CRAMER AND BRITT/10/
      AND SYSTEMATICS/11/ WERE ALSO CONSIDERED.

  MT= 4, 51-79, 91  INELASTIC SCATTERING CROSS SECTION
      CALCULATED WITH CASTHY (OPTICAL AND STATISTICAL MODEL).
      PARAMETERS USED ARE LISTED IN TABLES 1, 2 AND 3.  THE LEVEL
      SCHEME WAS TAKEN FROM EVALUATION BY ELLIS-AKOVALI/12,13/.

  MT= 102  CAPTURE CROSS SECTION
      CALCULATED WITH CASTHY.  AVERAGE CAPTURE WIDTH AND LEVEL
      SPACING WAS ASSUMED TO BE 0.035 EV AND 3.5 EV, RESPECTIVELY.
      DIRECT AND SEMI-DIRECT CAPTURE WAS CALCULATED FROM A SIMPLE
      FORMULA OF BENZI AND REFFO/14/.

  MT= 251  MU-L
      CALCULATED WITH CASTHY

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT= 2, 51-79, 91
      CALCULATED WITH CASTHY
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MT=16, 17, 18
ASSUMED TO BE ISOTROPIC IN THE LABORATORY SYSTEM.

MF=5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=16, 17, 91
EVAPORATION SPECTRA OBTAINED FROM THE LEVEL DENSITY PARAMETERS WERE GIVEN.
MT=18
EVAPORATION SPECTRA. TEMPERATURE WAS DETERMINED FROM SYSTEMATICS BY SMITH ET AL./15/

TABLE 1 OPTICAL POTENTIAL PARAMETERS
DETERMINED BY MURATA/16/ EXCEPT A CONSTANT TERM OF V THAT WAS SELECTED SO AS TO REPRODUCE S0 OF 1.0E-4.

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     V = 40.5 - 0.05*E (MEV)
    WS =  6.5 + 0.15*E (MEV): DERRIVATIVE WOOD-SAXON TYPE
   VSO =  7.0          (MEV)
    R0 = RSO = 1.32,  RS = 1.38   (FM)
     A = B = ASO = 0.47           (FM)
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TABLE 2 LEVEL SCHEME OF U-237 /12,13/

NO.	ENERGY(MEV)	SPIN-PARITY
G.S	0.0	1/2 +
1	0.01139	3/2 +
2	0.05630	5/2 +
3	0.08286	7/2 +
4	0.15996	5/2 +
5	0.20419	7/2 +
6	0.2740	7/2 -
7	0.3160	9/2 -
8	0.42615	7/2 +
9	0.4820	9/2 +
10	0.54062	1/2 -
11	0.55498	3/2 -
12	0.57801	5/2 -
13	0.66427	3/2 +
14	0.66645	5/2 +
15	0.67759	3/2 +
16	0.69765	5/2 +
17	0.72045	3/2 -
18	0.73434	1/2 -
19	0.75816	3/2 -
20	0.83245	5/2 +
21	0.84694	1/2 +
22	0.8650	1/2 -
23	0.87215	3/2 +
24	0.89343	5/2 +
25	0.9034	3/2 -
26	0.9057	1/2 +
27	0.9094	1/2 -
28	0.9110	5/2 -
29	0.9206	3/2 +

LEVELS ABOVE 0.94785 MEV WERE ASSUMED TO BE OVERLAPPING.

TABLE 3 LEVEL DENSITY PARAMETERS FOR GILBERT AND CAMERON FORMULA, BASED ON THE EXCITED LEVELS GIVEN IN ENSDF AND RESONANCE LEVEL SPACINGS /17/.

	A(1/MEV)	T(MEV)	PAIRING ENERGY(MEV)	SPIN-CUTOFF F. (MEV**0.5)	EX(MEV)
U-235	31.4	0.39	0.69	31.55	4.1984
U-236	30.42	0.39	1.18	30.752	4.5349
U-237	31.6	0.37	0.69	31.431	3.807
U-238	30.1	0.38	1.12	30.762	4.227

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MAT number = 9237

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 92-U -238 KYU,JAERI+ EVAL-APR87 Y.KANDA ET AL.
                      DIST-SEP89 REV2-MAR94
HISTORY
87-01 SIMULTANEOUS EVALUATION FOR FISSION AND CAPTURE CROSS
      SECTIONS WAS COMPLETED IN THE ENERGY RANGE ABOVE 50 KEV.
87-04 OTHER QUANTITIES WERE EVALUATED BY
        Y. KANDA AND Y. UENOHARA (KYUSHU UNIV.): MF'S = 3, 4 AND 5
                 ABOVE RESONANCE REGION.
        T. NAKAGAWA (JAERI) : RESOLVED RESONANCE PARAMETERS AND
                 BACKGROUND CROSS SECTIONS.
        K. HIDA (NAIG) : DATA FOR GAMMA-RAY PRODUCTION.
88-03 DATA OF TOTAL, ELASTIC, INELASTIC (MT=59,60) AND CAPTURE
      CROSS SECTIONS WERE PARTLY MODIFIED.
89-03 DATA OF TOTAL, ELASTIC, INELASTIC AND CAPTURE CROSS SECTIONS
      WERE MODIFIED.  UNRESOLVED RESONANCE PARAMETERS WERE ALSO
      MODIFIED.  FP YIELDS WERE ADDED.
94-03 JENDL-3.2.
      INELASTIC SCATTERING AND (N,3N) CROSS SECTIONS RE-EVALUATED
          BY Y.KANDA AND T.KAWANO (KYUSHU UNIV.)/1/
      RESOLVED RESONANCE PARAMETERS MODIFIED BY T.NAKAGAWA(JAERI)
      UNRESOLVED RESONANCE PARAMETERS MODIFIED BY Y.KIKUCHI(JAERI)
      FISSION SPECTRA CALCULATED BY T.OHSAWA(KINKI UNIV.)
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)         RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
                      UP TO 150 KEV
      (3,2), (3,4), (3,17), (3,51-91)
                      MAINLY INELASTIC SCATTERING CROSS SECTIONS.
      (4,51-83)
      (5,18)          NEW CALCULATION CONSIDERING MULTI-CHANCE
                      FISSION.
      (5,91)          CONTRIBUTION FROM PRECOMPOUND PROCESS ADDED.
      (12,51-57)      BASED ON NEWLY ADOPTED LEVEL SCHEME.
      (13,3), (15,3), (12,102), (15,102)  LOWEST ENERGY OF MT=3
                      WAS CHANGED TO 934.74 KEV
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MF=1  GENERAL INFORMATION
  MT=451  DESCRIPTIVE DATA AND DIRECTORY RECORDS
  MT=452  NUMBER OF NEUTRONS PER FISSION
     SUM OF MT'S= 455 AND 456
  MT=455  DELAYED NEUTRON DATA
     TAKEN FROM REF./2/.
  MT=456  NUMBER OF PROMPT NEUTRONS PER FISSION
     TAKEN FROM EVALUATION BY FREHAUT /3/.

MF=2 RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  1) RESOLVED RESONANCE PARAMETERS FOR MLBW FORMULA
         (RESOLVED RESONANCE REGION = 1.0E-5 EV TO 10 KEV)
      PARAMETERS WERE ADOPTED FROM JEF-2 EVALUATION /4/ AND THE
      ENERGY RANGE WAS DIVIDED INTO 10 INTERVALS BY ASSUMING
      HYPOTHETICAL RESONANCES OUTSIDE EACH INTERVAL.  PARAMETERS
      OF THE HYPOTETICAL RESONANCES WERE DETERMINED BY MEANS OF
      SAMMY/5/.

  2) UNRESOLVED RESONANCE PARAMETERS
         (UNRESOLVED RESONANCE REGION = 10 KEV TO 150 KEV)
      PARAMETERS WERE OBTAINED WITH THE PARAMETER FITTING CODE
      ASREP/6/ SO AS TO REPRODUCE THE CROSS SECTIONS EVALUATED IN
      THIS ENERGY REGION.

   2200-M/S CROSS SECTIONS AND CALCULATED RESONANCE INTEGRALS.
                       2200 M/S(B)     RES. INTEG.(B)
         TOTAL        12.077
         ELASTIC       9.360
         FISSION       11.8E-6           1.72
         CAPTURE       2.717           277.

MF=3  NEUTRON CROSS SECTIONS
     BELOW 10 KEV, NO BACKGROUND CROSS SECTIONS WERE GIVEN.
     ABOVE 10 KEV, CROSS SECTIONS WERE EVALUATED AS FOLLOWS, AND
     THEY WERE REPRESENTED WITH THE UNRESOLVED RESONANCE
     PARAMETERS EXCEPT THE FISSION CROSS SECTION.

  MT=1  TOTAL
     THE SAME AS JENDL-2 WHICH WERE BASED ON THE FOLLOWING
     EXPERIMENTAL DATA.
        BELOW 500 KEV: UTTLEY ET AL./7/, WHALEN ET AL./8/.
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                POENITZ ET AL./9/, TSUBONE ET AL./10/
  0.5 - 4.5 MEV: POENITZ ET AL./9/, TSUBONE ET AL./10/,
                KOPSCH ET AL./11/.
  4.5 - 15 MEV : FOSTER AND GLASGOW /12/
  15 - 20 MEV  : BRATENAHL ET AL./13/, PETERSON ET
                AL./14/.

MT=2  ELASTIC SCATTERING
   CALCULATED AS (TOTAL)-(PARTIAL CROSS SECTIONS)

MT=4, 51-83, 91  TOTAL AND PARTIAL INELASTIC SCATTERING
   CROSS SECTIONS WERE CALCULATED BY TAKING ACCOUNT OF DIRECT
   AND COMPOUND PROCESSES.
 1) DIRECT PROCESS
   COUPLED-CHANNEL MODEL CODE ECIS88/15/ WAS USED FOR CALCULA-
   TION OF DIRECT INELASTIC CROSS SECTIONS TO THE EXCITED LEVELS
   WHICH BELOG TO THE VIBRATIONAL BANDS AND THE GROUND STATE
   ROTATIONAL BAND.  FOR THE LEVELS OF MT = 65, 68, 73, 76 AND
   77, THE DIRECT CROSS SECTIONS WERE NOT INCLUDED.  THE OPTICAL
   POTENTIAL PARAMETERS WERE TAKEN FROM REF./16/.
           V0=46.2 - 0.3E, WS = 3.6 + 0.4E, VSO = 6.2 (MEV)
           R = 1.26, RS=1.26, RSO=1.12                (FM)
           A = 0.63, AS=0.52, ASO=0.47                (FM)
           BETA-2 =0.198, BETA-4 =0.057
   THE BAND COUPLING STRENGTH (BETA) WAS DETERMINED FROM THE
   EXPERIMENTAL CROSS SECTION DATA/17, 18, 19, 20, 21/ AND
   DDX DATA/22/.

 2) COMPOUND PROCESS:
   COMPOUND INELASTIC SCATTERING CROSS SECTIONS TO THE 1ST AND
   2ND LEVELS WERE CALCULATED WITH ECIS88/15/.  THOSE TO THE
   OTHER LEVELS WERE CALCULATED USING HAUSER-FESHBACH-MOLDAUER
   (HFM) THEORY/23/.  THE OPTICAL POTENTIAL PARAMETERS/24/
   USED IN HFM CALCULATION ARE AS FOLLLOWS:
           V0 = 50.378-0.354E-27.073(N-Z)/A,          (MEV)
           WS = 9.265-0.232E+0.03318E**2-12.666(N-Z)/A, (MEV)
           VSO= 6.2,                                  (MEV)
           R  = 1.264, A  = 0.612,                    (FM)
           RS = 1.256, AS = 0.553+0.0144E,            (FM)
           RSO= 1.1,   ASO= 0.75                      (FM)
   IN ORDER TO GET BETTER AGREEMENT WITH EXPERIMENTAL DATA OF
   THE TOTAL INELASTIC SCATTERING CROSS SECTION/22, 25, 26/, A
   FACTOR OF 0.91 WAS MULTIPLIED TO THE CALCULATED COMPOUND
   PROCESS CROSS SECTION EXCEPT FOR THE FIRST LEVEL.

    LEVEL SCHEME /27/
   --------------------
         NO.      ENERGY(MEV)    SPIN-PARITY
         G.S.     0.0              0 +
          1       0.044910         2 +
          2       0.14841          4 +
          3       0.30721          6 +
          4       0.6801           1 -
          5       0.7319           3 -
          6       0.8267           5 -
          7       0.9257           0 +
          8       0.9308           1 -
          9       0.9502           2 -
         10       0.9673           2 +
         11       0.993            0 +
         12       0.9975           3 -
         13       1.0373           2 +
         14       1.0566           4 +
         15       1.0595           3 +
         16       1.0603           2 +
         17       1.1057           3 +
         18       1.1126           1 -
         19       1.127            4 +
         20       1.1287           2 -
         21       1.168            4 +
         22       1.1704           3 -
         23       1.2242           2 +
         24       1.2326           4 -
         25       1.2692           6 +
         26       1.2785           1 -
         27       1.2858           5 -
            CONTINUUM LEVELS WERE ASSUMED ABOVE 1.29 MEV.

    THE FOLLOWING HYPOTHETICAL LEVELS WERE INTRODUCED SO AS TO
    REPRODUCE WELL THE MEASURED DDX DATA/22/.
         28       1.5
         29       2.0
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          30      2.5
          31      3.0
          32      3.5
          33      4.0

  MT=16  (N,2N)
     SMOOTH CROSS SECTION WAS DETERMINED ON THE BASIS OF FREHAUT
     ET AL./28/ BELOW 15 MEV, AND VEESER ET AL./25/ AND KARIUS ET
     AL./29/ ABOVE 15 MEV.

  MT=17  (N,3N)
     BASED ON VEESER ET AL./30/  ABOVE 16 MEV, RENORMALIZED SO
     THAT CONSISTENCY MIGHT BE KEPT AMONG FISSION, CAPTURE, (N,2N)
     AND INELASTIC SCATTERING CROSS SECTIONS.

  MT=18  FISSION
     BELOW 100 KEV : TAKEN FROM EXPERIMENTAL DATA /31/.
     100 - 600 KEV : EVALUATED ON THE BASIS OF THE DATA OF
          DIFFILIPPO ET AL. /32/, BEHRENS AND CARLSON /33/,
          NORDBORG ET AL. /34/ AND MEADOWS /35,36/.
     ABOVE 600 KEV : RESULTS OF SIMULTANEOUS EVALUATION /37/ MADE
          BY CONSIDERING THE EXPERIMENTAL DATA OF REFS./33,34,
          35,36,38,39,40,41,42,43,44,45,46,47/.

  MT=102  CAPTURE
     BELOW 300 KEV, EVALUATION WAS MAINLY BASED ON THE DATA
     MEASURED BY KAZAKOV ET AL./48/.  ABOVE 300 KEV, DATA WERE
     TAKEN FROM JENDL-2 WHICH WERE DETERMINED MAINLY FROM THE
     MEASUREMENTS BY POENITZ /47/, PANITKIN AND SHERMAN /49/,
     MOXON /50/, FRICKE ET AL. /51/ AND MENLOVE AND POENITZ
     /52/.  AT HIGH ENERGIES, SLIGHT MODIFICATION WAS MADE.

  MT=251  MU-L BAR
     CALCULATED FROM THE ANGULAR DISTRIBUTIONS IN MF=4, MT=2.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2             CALCULATED WITH ECIS/53/, CASTHY/54/ AND
                   ELIESE-3/55/.
  MT=51,52         CALCULATED WITH ECIS88/15/.
  MT=53-64,66,67,69-72,74,75
                   CALCULATED WITH ECIS88, HAUSER-FESHBACH-MOLDAUER
                   (HFM) THEORY.
  MT=65,68,73,76,77
                   CALCULATED WITH HFM THEORY.
  MT=16,17,18,91   ASSUMED TO BE ISOTROPIC IN THE LAB. SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17     EVAPORATION SPECTRUM.
  MT=91        CALCULATED WITH GNASH/56/.
  MT=18
     DISTRIBUTIONS WERE CALCULATED WITH THE MODIFIED MADLAND-NIX
     MODEL/57,58/.  THE COMPOUND NUCLEUS FORMATION CROSS SECTIONS
     FOR FISSION FRAGMENTS (FF) WERE CALCULATED USING BECHETTI-
     GREENLEES POTENTIAL/59/.  UP TO 4TH-CHANCE-FISSION WERE
     CONSIDERED AT HIGH INCIDENT NEUTTRON ENERGIES.  THE IGNATYUK
     FORMULA/60/ WERE USED TO GENERATE THE LEVEL DENSITY
     PARAMETERS.
       PARAMETERS ADOPTED:
           TOTAL AVERAGE FF KINETIC ENERGY = 167.41 - 172.65 MEV
           AVERAGE ENERGY RELEASE          = 186.115 - 186.364 MEV
           AVERAGE MASS NUMBER OF LIGHT FF = 99 - 111
           AVERAGE MASS NUMBER OF HEAVY FF = 128 - 140
           LEVEL DENSITY OF THE LIGHT FF   = 10.106 - 10.963
           LEVEL DENSITY OF THE HEAVY FF   = 11.441 - 7.811
           RATIO OF NUCLEAR TEMPERATURE
                     FOR LIGHT TO HEAVY FF = 1.0
       NOTE THAT THE PARAMETERS VARY WITH THE INCIDENT ENERGY
       WITHIN THE INDICATED RANGE.
  MT=455
     TAKEN FROM SAPHIER ET AL. /61/

MF=8  FISSION PRODUCT YIELDS DATA
  MT=454  INDEPENDENT YIELDS
  MT=459  CUMULATIVE YIELDS
     BOTH WERE TAKEN FROM JNDC FP DECAY DATA FILE VERSION-2/62/.

MF=12 PHOTON PRODUCTION MULTIPLICITIES (OPTION 1)
      GIVEN FOR THE FOLLOWING SECTIONS BELOW 934.74 KEV.
  MT=18   FISSION
      THE THERMAL NEUTRON-INDUCED FISSION GAMMA SPECTRUM OF U-235
      MEASURED BY VERBINSKI /63/ WAS ADOPTED FOR THE WHOLE ENERGY
      REGION.  THE INTENSITY OF PHOTON BELOW 0.14 MEV, WHERE NO
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DATA WERE GIVEN, WAS ASSUMED TO BE THE SAME AS THAT BETWEEN 0.14 AND 0.3 MEV.

MT=51-57 INELASTIC

PHOTON BRANCHING DATA WERE TAKEN FROM REF./64/, AND CONVERTED TO PHOTON MULTIPLICITIES.

MT=102 CAPTURE

CALCULATED WITH GNASH/56/. IN THE CASE WHERE THE OBTAINED MULTIPLICITIES WERE TOO LARGE, THEY WERE RENORMALIZED BY USING ENERGY BALANCE.

MF=13 PHOTON PRODUCTION CROSS SECTIONS

MT=3 NON-ELASTIC

PHOTON PRODUCTION CROSS SECTION CALCULATED WITH GNASH /56/ WERE GROUPED INTO THE NON-ELASTIC IN THE ENERGY RANGE ABOVE 934.74 KEV. TRANSMISSION COEFFICIENTS FOR INCIDENT CHANNEL WERE GENERATED WITH ECIS/53/, AND THOSE FOR EXIT CHANNEL WITH ELIESE-3/55/. THE DATA FOR FISSION WERE BASED ON THE MEASURED U-235 SPECTRA /63/. FURTHER DETAILS ARE GIVEN IN REF./65/

MF=14 ANGULAR DISTRIBUTIONS OF PHOTONS

ISOTROPIC DISTRIBUTIONS WERE ASSUMED FOR ALL SECTIONS.

MF=15 CONTINUOUS PHOTON ENERGY SPECTRA

MT=3 NON-ELASTIC

CALCULATED WITH GNASH /56/.

MT=18 FISSION

U-235 SPECTRA MEASURED BY VERBINSKI/63/.

MT=102 CAPTURE

CALCULATED WITH GNASH/56/.

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MAT number = 9343

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 93-NP-236 JAERI      EVAL-MAR93 T.NAKAGAWA
                      DIST-MAR94
HISTORY
93-03  NEW EVALUATION WAS MADE FOR JENDL-3.2.

MF=1  GENERAL INFORMATION
  MT=451  DESCRIPTIVE DATA AND DICTIONARY
  MT=452  TOTAL NUMBER OF NEUTRONS PER FISSION
      SUM OF NU-P (MT=456) AND NU-D (MT=455).
  MT=455  DELAYED NEUTRON DATA
      DETERMINED FROM SYSTEMATICS BY TUTTLE/1/, BENEDETTI/2/ AND
      WALDO ET AL./3/  DECAY CONSTANTS WERE TAKEN FROM THE EVALU-
      ATION FOR NP-238 BY BRADY AND ENGLAND/4/.
  MT=456  NUMBER OF PROMPT NEUTRONS
      BASED ON THE DATA BY LINDNER AND SEEGMILLER /5/ AND
      HOWERTON'S SYSTEMATICS/6/.

MF=2  RESONANCE PARAMETERS
  MT=151  NO RESONANCE PARAMETERS ARE GIVEN.

      THERMAL CROSS SECTIONS AND CALCULATED RES. INTEGRAL (BARNS)
                     0.0253 EV      RESONANCE INTEGRAL
        TOTAL        3483.                 -
        ELASTIC        12.27               -
        FISSION      2770.               1030
        CAPTURE       701.                259

MF=3  NEUTRON CROSS SECTIONS
  BELOW 20 KEV
  ============
  MT= 1    TOTAL CROSS SECTION
      SUM OF PARTIAL CROSS SECTIONS.

  MT= 2    ELASTIC SCATTERING CROSS SECTION
      CALCULATED WITH OPTICAL MODEL CODE CASTHY/7/.

  MT= 18   FISSION CROSS SECTION
      BASED ON THE DATA MEASURED BY VAL'SKIY ET AL./8/

  MT= 102  CAPTURE CROSS SECTION
      CAPTURE-TO-FISSION RATIO WAS ASSUMED TO BE 0.253 THAT WAS
      OBTAINED FROM THE CAPTURE CROSS SECTION CALCULATED AT 20 KEV
      AND THE FISSION CROSS SECTION.

  ABOVE 20 KEV
  ============
  MT= 1    TOTAL CROSS SECTION
      CALCULATED WITH OPTICAL MODEL CODE CASTHY/7/.  PARAMETERS
      ARE LISTED IN TABLE 1.

  MT= 2    ELASTIC SCATTERING CROSS SECTION
      TOTAL - (SUM OF PARTIAL CROSS SECTIONS)

  MT= 16, 17  (N,2N) AND (N,3N) CROSS SECTIONS
      CALCULATED FROM A FORMULA GIVEN BY SAGEV AND CANER/9/.
      THE REACTION CROSS SECTIONS CALCULATED WITH CASTHY WAS
      ADOPTED AS THE NON-ELASTIC SCATTERING CROSS SECTION.

  MT= 18   FISSION CROSS SECTION
      ABOVE 5 MEV, A SIMPLE FORMULA BY BYCHKOV ET AL./9/ WAS USED.
      EXPERIMENTAL DATA OF BRITT AND WILHELMY/10/ AND SYSTEMA-
      TICS/11/ WERE CONSIDERED.  THE CROSS-SECTION CURVE WAS
      SMOOTHLY CONNECTED AT 20 KEV TO THE DATA OF VAL'SKIY ET
      AL./8/

  MT= 4, 51-54, 91  INELASTIC SCATTERING CROSS SECTION
      CALCULATED WITH CASTHY (OPTICAL AND STATISTICAL MODEL).
      PARAMETERS USED ARE LISTED IN TABLES 1, 2 AND 3.  THE LEVEL
      SCHEME WAS TAKEN FROM EVALUATION BY SCHMORAK/12,13/.

  MT= 102  CAPTURE CROSS SECTION
      CALCULATED WITH CASTHY.  AVERAGE CAPTURE WIDTH AND LEVEL
      SPACING WAS ASSUMED TO BE 0.035 EV AND 0.11EV, RESPECTIVELY.
      DIRECT AND SEMI-DIRECT CAPTURE WAS CALCULATED FROM A SIMPLE
      FORMULA OF BENZI AND REFFO/14/.

  MT= 251  MU-L
      CALCULATED WITH CASTHY

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT= 2, 51-54, 91
```

CALCULATED WITH CASTHY

MT=16, 17, 18
ASSUMED TO BE ISOTROPIC IN THE LABORATORY SYSTEM.

MF=5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=16, 17, 91
EVAPORATION SPECTRA OBTAINED FROM THE LEVEL DENSITY PARAMETERS WERE GIVEN.
MT=18
EVAPORATION SPECTRA. TEMPERATURE WAS DETERMINED FROM SYSTEMATICS BY SMITH ET AL./15/

TABLE 1 OPTICAL POTENTIAL PARAMETERS
DETERMINED BY MURATA/16/ EXCEPT A CONSTANT TERM OF V THAT WAS SELECTED SO AS TO REPRODUCE SO OF 1.0E-4.

```
    V = 40.5 - 0.05*E (MEV)
   WS =  6.5 + 0.15*E (MEV): DERRIVATIVE WOOD-SAXON TYPE
  VSO =  7.0          (MEV)
   R0 = RSO = 1.32,  RS = 1.38   (FM)
    A = B = ASO = 0.47           (FM)
```

TABLE 2 LEVEL SCHEME OF NP-236 /12,13/

NO.	ENERGY(MEV)	SPIN-PARITY
G.S	0.0	6 -
1	0.060	1 +
2	0.231	3 -
3	0.273	4 -
4	0.324	5 -

LEVELS ABOVE 0.370 MEV WERE ASSUMED TO BE OVERLAPPING.

TABLE 3 LEVEL DENSITY PARAMETERS FOR GILBERT AND CAMERON FORMULA, BASED ON THE EXCITED LEVELS GIVEN IN ENSDF.

	A(1/MEV)	T(MEV)	PAIRING ENERGY(MEV)	SPIN-CUTOFF F. (MEV**0.5)	EX(MEV)
NP-234*	27.16		0.0	17.57	3.1410
NP-235	31.4	0.35	0.57	31.16	3.2900
NP-236	28.0	0.35	0.0	29.50	2.2579
NP-237	29.6	0.39	0.49	30.42	3.7161

* TAKEN FROM GILBERT AND CAMERON/17/

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MAT number = 9346

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 93-NP-237 KYUSHU U.+ EVAL-NOV87 Y.UENOHARA, Y.KANDA
                      DIST-JAN88 REV2-AUG93
HISTORY
79-03 NEW EVALUATION WAS MADE BY N.WACHI AND Y.KANDA (KYUSHU
      UNIVERSITY), AND Y.KIKUCHI (JAERI).
87-11 (N,2N), (N,3N) AND FISSION CROSS SECTIONS WERE RE-EVALUATED
      IN THE ENERGY RANGE ABOVE 100 KEV BY Y.UENOHARA AND Y.KANDA
      (KYUSHU UNIVERSITY).
88-01 COMPILED BY T.NAKAGAWA (JAERI).
        MODIFIED QUANTITIES : (1,452), (1,456), (3,2), (3,16)
                              (3,17) AND (3,18)
89-02 FP YIELDS WERE TAKEN FROM JNDC FP DECAY FILE VERSION-2.
89-03 (N,2N) REACTION CROSS SECTION WAS MODIFIED.
93-08 JENDL-3.2.
      MODIFIED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)
      (3,18)            BELOW 350 KEV
      (8,16)
      (9,16)
     ***********************************************************


MF=1  GENERAL INFORMATION
  MT=451   COMMENTS AND DICTIONARY
  MT=452   NUMBER OF NEUTRONS PER FISSION
              SUM OF MT=455 AND MT=456.
  MT=455   DELAYED NEUTRON DATA
              EXPERIMENTAL DATA OF BENEDETTI+/1/ AND SYSTEMATICS
              BY TUTTLE/2/.
  MT=456   NUMBER OF NEUTRONS PER FISSION
              BASED ON EXPERIMENTAL DATA OF FREHAUT+/3/.

MF=2, MT=151  RESONANCE PARAMETERS
   RESOLVED RESONANCES FOR SLBW FORMULA : 1.0E-5 - 130 EV
           RES. ENERGY, GAM-N, GAM-G:  WESTON AND TODD /4/.
           GAM-F                    :  PLATTARD+ /5/.
             --> FOR JENDL-3.2, 5 TIMES LARGE VALUES ARE USED ON
                 THE BASIS OF NEW MEASUREMENT AT KYOTO UNIV./6/.
           AVERAGE GAM-G = 40 MILLI-EV.
           TWO NEGATIVE RESONANCE ARE GIVEN.  PARAMETERS OF
           0.22-EV RESONACE WERE ADJUSTED SO AS TO REDUCE THE
           THERMAL CAPTURE CROSS SECTION/7/
   UNRESOLVED RESONANCES  : 130 EV - 30 KEV
        PARAMETERS BY WESTON AND TODD/4/ WITH SLIGHT MODIFICATION
        ADOPTED PARAMETERS :
           S0=1.02E-4 , S1=1.888E-4 , D-OBS=0.45 EV
           GAM-G=40 MILLI-EV.
        GAM-F VALUES DETERMINED SO THAT SIG-F = 0.009 B.

   CALCULATED 2200 M/S CROSS SECTIONS AND RESONANCE INTEGRALS:
                         2200 M/S VALUE      RES.INT.
           TOTAL    :      192.11  B            -
           ELASTIC :        27.44  B            -
           FISSION :       0.0225  B          7.06  B
           CAPTURE :       164.6   B         662    B

MF=3  NEUTRON CROSS SECTIONS
  MT=1,4,51-64,91,102,251   TOTAL, INELASTIC, CAPTURE AND MU-BAR
        CALCULATED WITH OPTICAL AND STATISTICAL MODEL CODE CASTHY
        /8/.
            THE SPHERICAL OPTICAL POTENTIAL PARAMETERS :
              V = 43.55     ,  WS = 11.0  ,  VSO = 7.0    (MEV)
              R = RS = 1.32  ,  RSO= 1.3                  (FM)
              A = B  = 0.47  ,  ASO= 0.4                  (FM).
        IN THE STATISTICAL MODEL CALCULATION WITH CASTHY CODE,
        COMPETING PROCESSES, FISSION, (N,2N) AND (N,3N), AND LEVEL
        FLUCTUATION WERE CONSIDERED.  THE LEVEL SCHEME WAS TAKEN
        FROM COMPILATION BY ELLIS /9/.
                    NO         ENERGY(MEV)        SPIN-PARITY
                   G.S.           0.0                 5/2+
                    1             0.03320             7/2+
                    2             0.05954             5/2-
                    3             0.07580             9/2+
                    4             0.10296             7/2-
                    5             0.13000            11/2+
                    6             0.15852             9/2-
                    7             0.2260             11/2-
                    8             0.26754             3/2-
                    9             0.281               1/2-
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                 10             0.305            13/2-
                 11             0.327             7/2-
                 12             0.332             1/2+
                 13             0.357             5/2-
                 14             0.369             5/2+
          CONTINUUM LEVELS ASSUMED ABOVE 0.370 MEV.
        THE LEVEL DENSITY PARAMETERS WERE TAKEN FROM GILBERT AND
        CAMERON /10/.  THE GAMMA-RAY STRENGTH FUNCTION FOR THE
        CAPTURE CROSS SECTION WAS DETERMINED SO THAT SIG-C = 0.742
        B AT 200 KEV.

  MT=2             ELASTIC SCATTERING
        CALCULATED AS (TOTAL - SUM OF PARTIAL CROSS SECTIONS).

  MT=16            (N,2N)
        FOR JENDL-2, DATA WERE CALCULATED WITH THE EVAPORATION
        MODEL OF SEGEV+/11/.  THE DATA FOR JENDL-3 WERE EVALUATED
        BY FITTING TO THE FOLLOWING EXPERIMENTAL DATA.
           PERKIN+ /12/, LANDRUM+ /13/, LINDKE+ /14/, FORT+ /15/,
           GROMOVA+ /16/ AND KORNILOV+ /17/.
        THE DATA OF JENDL-2 WERE USED AS PRIOR VALUES, AND 50%
        FRACTIONAL STANDARD DEVIATIONS WERE ASSIGNED TO THEM.

  MT=17            (N,3N)
        FOR JENDL-2, CALCULATED WITH THE EVAPORATION MODEL OF
        SEGEV+ /11/.  ABOVE 16.5 MEV, THE JENDL-2 DATA WERE
        MODIFIED BY ADDING THE VALUES OF (SIG-2N OF JENDL-2)-
        (SIG-2N OF JENDL-3).  BELOW 16.5 MEV, THE SHAPE OF (N,3N)
        CROSS SECTION OF JENDL-2 WAS NORMALIZED TO THE MODIFIED
        VALUE AT 16.5 MEV.

  MT=18            FISSION
        EVALUATED FROM MEASURED DATA.  ABOVE 100 KEV, SIMULTANEOUS
        EVALUATION METHOD WAS USED BY TAKING ACCOUNT OF THE
        FOLLOWING EXPERIMENTAL DATA.
          KLEMA /18/, PROTOPOPOV+ /19/, SCHMITT+ /20/, GRUNDL
          /21/, IYER+ /22/, JIACOLETTI+ /23/, KOBAYASHI+ /24/,
          ARLT+ /25/, CANCE+ /26/, GARLEA+ /27/, KUPRIJANOV+ /28/,
          WHITE+ /29,30/, STEIN+ /31/, BEHRENS+ /32/ AND MEADOWS
          /33/.
        FOR JENDL-3.2, CROSS SECTIONS BELOW 350 KEV WAS MODIFIOED
        AS AS TO SMOOTHLY CONNECT TO THE DATA MESURED BY YAMANAKA+
        /6/

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,51-64,91    CALCULATED WITH THE OPTICAL MODEL.
  MT=16,17,18      ISOTROPIC IN THE LABORATORY SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,91      EVAPORATION SPECTRUM.
  MT=18            ESTIMATED FROM Z**2/A SYSTEMATICS BY SMITH+/34/
                   BY ASSUMING E(CF-252) = 2.13 MEV.

MF=8  RADIOACTIVE DECAY AND FISSION PRODUCT YIELDS
  MT=16
      DECAY DATA OF NP-236 ARE GIVEN.
  MT=454 AND 459
      BOTH WERE TAKEN FROM JNDC FP DECAY DATA FILE VERSION-2/35/.

MF=9  MULTIPLICITIES FOR PRODUCTION OF RADIOACTIVE NUCLIDES
  MT=16
      META-STABLE STATE (T-1/2 =22.5 H) PRODUCTIOIN WAS ASSUMED TO
      BE 75 %.
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MAT number = 9349

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 93-NP-238 JAERI      EVAL-MAR93 T.NAKAGAWA
                      DIST-MAR94
HISTORY
93-03  NEW EVALUATION WAS MADE FOR JENDL-3.2.

MF=1  GENERAL INFORMATION
  MT=451  DESCRIPTIVE DATA AND DICTIONARY
  MT=452  TOTAL NUMBER OF NEUTRONS PER FISSION
      SUM OF NU-P (MT=456) AND NU-D (MT=455).
  MT=455  DELAYED NEUTRON DATA
      DETERMINED FROM SYSTEMATICS BY TUTTLE/1/, BENEDETTI/2/ AND
      WALDO ET AL./3/  DECAY CONSTANTS WERE TAKEN FROM THE EVALU-
      ATION BY BRADY AND ENGLAND/4/.
  MT=456  NUMBER OF PROMPT NEUTRONS
      BASED ON THE DATA BY SOLONKIN ET AL./5/ AND HOWERTON'S
      SYSTEMATICS/6/.  A CONSTANT TERM IS AN AVERAGE OF THESE
      TWO.

MF=2  RESONANCE PARAMETERS
  MT=151  NO RESONANCE PARAMETERS ARE GIVEN.

      THERMAL CROSS SECTIONS AND CALCULATED RES. INTEGRAL (BARNS)
                     0.0253 EV      RESONANCE INTEGRAL
        TOTAL        2532.5               -
        ELASTIC        12.41              -
        FISSION      2070.               940
        CAPTURE       450.               201

MF=3  NEUTRON CROSS SECTIONS
  MT= 1    TOTAL CROSS SECTION
      CALCULATED WITH OPTICAL MODEL CODE CASTHY/7/.  PARAMETERS
      ARE LISTED IN TABLE 1.

  MT= 2    ELASTIC SCATTERING CROSS SECTION
      TOTAL - (SUM OF PARTIAL CROSS SECTIONS)

  MT= 16, 17  (N,2N) AND (N,3N) CROSS SECTIONS
      CALCULATED FROM A FORMULA GIVEN BY SAGEV AND CANER/8/.
      THE REACTION CROSS SECTIONS CALCULATED WITH CASTHY WAS
      ADOPTED AS THE NON-ELASTIC SCATTERING CROSS SECTION.

  MT= 18   FISSION CROSS SECTION
      CROSS SECTION OF 2070 BARNS MEASURED BY SPENCER AND BAUMANN
      AT 0.0253 EV/9/ WAS ADOPTED AND 1/V FORM ASSUMED BELOW 20
      KEV.  ABOVE 6.6 MEV, A SIMPLE FORMULA BY BYCHKOV ET AL./8/
      WAS USED.  BELOW THIS, EXPERIMENTAL DATA OF BRITT AND
      WILHELMY/10/ AND SYSTEMATICS/11/ WERE CONSIDERED.  THE
      CROSS-SECTION CURVE WAS SMOOTHLY CONNECTED AT 20 KEV TO THE
      ABOVE-MENTIONED DATA.

  MT= 4, 51-79, 91  INELASTIC SCATTERING CROSS SECTION
      CALCULATED WITH CASTHY (OPTICAL AND STATISTICAL MODEL).
      PARAMETERS USED ARE LISTED IN TABLES 1, 2 AND 3.  THE LEVEL
      SCHEME WAS TAKEN FROM EVALUATION BY SHURSHIKOV/12,13/.

  MT= 102  CAPTURE CROSS SECTION
      CALCULATED WITH CASTHY.  AVERAGE CAPTURE WIDTH AND LEVEL
      SPACING WAS ASSUMED TO BE 0.035EV AND 0.294EV, RESPECTIVELY.
      DIRECT AND SEMI-DIRECT CAPTURE WAS CALCULATED FROM A SIMPLE
      FORMULA OF BENZI AND REFFO/14/.

  MT= 251  MU-L
      CALCULATED WITH CASTHY

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT= 2, 51-79, 91
      CALCULATED WITH CASTHY

  MT=16, 17, 18
      ASSUMED TO BE ISOTROPIC IN THE LABORATORY SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16, 17, 91
      EVAPORATION SPECTRA OBTAINED FROM THE LEVEL DENSITY
      PARAMETERS WERE GIVEN.
  MT=18
      EVAPORATION SPECTRA.  TEMPERATURE WAS DETERMINED FROM
      SYSTEMATICS BY SMITH ET AL./15/

    TABLE 1   OPTICAL POTENTIAL PARAMETERS
              DETERMINED BY MURATA/16/ EXCEPT A CONSTANT TERM OF V
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THAT WAS SELECTED SO AS TO REPRODUCE S0 OF 1.0E-4.

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--------------------------------------------------------------
    V = 40.5 - 0.05*E (MEV)
   WS =  6.5 + 0.15*E (MEV): DERRIVATIVE WOOD-SAXON TYPE
  VSO =  7.0          (MEV)
   R0 = RSO = 1.32,  RS = 1.38  (FM)
    A = B = ASO = 0.47          (FM)
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TABLE 2 LEVEL SCHEME OF NP-238 /12,13/

NO.	ENERGY(MEV)	SPIN-PARITY
G.S	0.0	2 +
1	0.02643	3 +
2	0.06222	4 +
3	0.08665	3 +
4	0.10626	5 +
5	0.12176	4 +
6	0.13601	3 -
7	0.16577	5 +
8	0.17915	4 -
9	0.18286	2 -
10	0.21548	3 -
11	0.22120	6 +
12	0.23280	5 -
13	0.25870	4 -
14	0.27558	5 +
15	0.2860	1 -
16	0.2983	6 -
17	0.30091	6 -
18	0.3286	6 +
19	0.3325	1 +
20	0.34238	5 -
21	0.3501	3 -
22	0.36841	2 -
23	0.3741	2 +
24	0.4085	6 -
25	0.4313	4 +
26	0.4404	4 -
27	0.4563	5 +
28	0.4626	6 +
29	0.5242	6 +

LEVELS ABOVE 0.528 MEV WERE ASSUMED TO BE OVERLAPPING.

TABLE 3 LEVEL DENSITY PARAMETERS FOR GILBERT AND CAMERON FORMULA, BASED ON THE EXCITED LEVELS GIVEN IN ENSDF AND RESONANCE LEVEL SPACINGS /17/.

	A(1/MEV)	T(MEV)	PAIRING ENERGY(MEV)	SPIN-CUTOFF F. (MEV**0.5)	EX(MEV)
NP-236	28.0	0.35	0.0	29.50	2.2579
NP-237	29.6	0.39	0.49	30.42	3.7161
NP-238	30.0	0.344	0.0	30.71	2.4075
NP-239	30.38	0.376	0.43	31.00	3.4944

* TAKEN FROM GILBERT AND CAMERON/18/

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MAT number = 9352
 93-NP-239 KYUSHU U.+ EVAL-MAR76 Y.KANDA, JENDL-CG
                      DIST-SEP89 REV2-JUN94
HISTORY
76-03 THE EVALUATION FOR JENDL-1 WAS PERFORMED BY KANDA (KYUSHU
      UNIV.) AND JENDL-1 COMPILATION GROUP.  DETAILS ARE GIVEN
      IN REF. /1/.
83-03 JENDL-1 DATA WERE ADOPTED FOR JENDL-2 AND EXTENDED TO 20
      MEV.  MF=5 WAS REVISED.
87-07 DATA FORMAT WAS CONVERTED INTO ENDF-5 FORMAT AND ADOPTED
      TO JENDL-3.
94-06 JENDL-3.2.
       NU-P, NU-D AND NU-TOTAL WERE MODIFIED.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (1,452), (1,455), (1,456)
     ***********************************************************


MF=1  GENERAL INFORMATION
  MT=451  DESCRIPTIVE DATA AND DICTIONARY
  MT=452 NUMBER OF NEUTRONS PER FISSION
     SUM OF NU-P NAD NU-D.
  MT=455 DELAYED NEUTRONS PER FISSION
     AVERAGE VALUES OF SYSTEMATICS BY TUTTLE/2/, BENEDETTI ET
     AL./3/ AND WALDO ET AL./4/  DECAY CONSTANTS WERE ASSUMED TO
     BE THE SAME AS THOSE OF NP-237 EVALUATED BY BRADY AND
     ENGLAND/5/.
  MT=456 PROMPT NEUTRONS PER FISSION
     BASED ON SYSTEMATICS BY MANERO AND KONSHIN/6/, AND BY
     HOWERTON/7/.

MF=2  RESONANCE PARAMETERS
  MT=151 NO RESONANCE PARAMETERS WERE GIVEN.

     2200-M/SEC CROSS SECTIONS AND CALCULATED RESONANCE INTEGRALS.
                       2200 M/SEC         RES. INTEG.
         TOTAL          47.50 B              -
         ELASTIC        10.50 B              -
         FISSION         0.0  B            7.06 B
         CAPTURE        37.00 B          445.   B

MF=3  NEUTRON CROSS SECTIONS
  BELOW 4.0 EV.
  MT=1    TOTAL
     SUM OF PARTIAL CROSS SECTIONS.
  MT=2    ELASTIC SCATTERING
     THE CONSTANT CROSS SECTION OF 10.5 BARNS WAS ASSUMED FROM
         SIG=4*3.14*(0.147*A**(1/3))**2.
  MT=18   FISSION
     ASSUMED TO BE ZERO BARNS.
  MT=102  CAPTURE
     THE FORM OF 1/V WAS ASSUMED.  THE 2200-M/SEC CROSS SECTION
     WAS ADOPTED FROM THE EXPERIMENTAL DATA BY STOUGHTON AND
     HALPERIN /8/.
  ABOVE 4.0 EV.
  MT=1    TOTAL
     CALCULATED WITH OPTICAL AND STATISTICAL MODEL CODE CASTHY
     /9/.  OPTICAL POTENTIAL PARAMETERS WERE OBTAINED BY OHTA AND
     MIYAMOTO /10/ BY USING THE TOTAL CROSS SECTION OF PU-239.
        V = 45.87-0.2*EN, WI= 0.06, WS= 14.1, VSO= 7.3 (MEV)
        R = 1.27        , RI= 1.27, RS=1.302, RSO= 1.27(FM)
        A0= 0.652       , AI=0.315, AS= 0.98, ASO=0.652(FM)
  MT=2  ELASTIC SCATTERING
     CALCULATED WITH CASTHY /9/.
  MT=4,51-58,91  INELASTIC SCATTERING
     CALCULATED WITH CASTHY /9/.  THE LEVEL SCHEME WAS ADOPTED
     FROM NUCL. DATA SHEETS VOL.6.
           NO.      ENERGY(MEV)  SPIN-PARITY
          G.S.       0.0           5/2 +
            1        0.03114       7/2 +
            2        0.07112       9/2 +
            3        0.07467       5/2 -
            4        0.11766      11/2 +
            5        0.1230        7/2 -
            6        0.17305       9/2 -
            7        0.2414       11/2 -
            8        0.320        13/2 -
     LEVELS ABOVE 430 KEV WERE ASSUMED TO OVERLAPPING.  IN THE
     CALCULATION THE CAPTURE, FISSION, (N,2N) AND (N,3N) CROSS
     SECTIONS WERE CONSIDERED AS COMPETING PROCESSES.
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  MT=16,17  (N,2N) AND (N,3N)
     CALCULATED WITH PEARLSTEIN'S METHOD /11/.
  MT=18  FISSION
     ESTIMATED FROM THE NP-237 FISSION CROSS SECTION BY NORMALI-
     ZING WITH NEUTRON SEPARATION ENERGIES.
  MT=102  CAPTURE
     BELOW 100 KEV, THE CROSS SECTION WAS CALCULATED FROM
         SIG = 435 / SQRT(EN) BARNS.
     ABOVE 100 KEV, THE SHAPE OF THE EXPERIMENTAL DATA FOR NP-237
     BY NAGLE ET AL. /12/ WAS ADOPTED AND NORMALIZED TO 1.4 BARNS
     AT 100 KEV.
  MT=251 MU-BAR
     CALCULATED WITH CASTHY /9/.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2                CALCULATED WITH CASTHY CODE /9/.
  MT=51-58            ISOTROPIC IN THE CENTER-OF-MASS SYSTEM.
  MT=16,17,18,91      ISOTROPIC IN THE LABORATORY SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,91         EVAPORATION SPECTRUM.
  MT=18               MAXWELLIAN FISSION SPECTRUM ESTIMATED FROM
                      Z**2/A SYSTEMATICS /13/.
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MAT number = 9428

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 94-PU-236 MAPI,JAERI EVAL-APR79 T.HOJUYAMA, Y.KIKUCHI, T.NAKAGAWA
                       DIST-SEP89 REV2-JUN94
HISTORY
79-04 NEW EVALUATION WAS MADE BY T.HOJUYAMA (MAPI) /1/ IN THE
      ENERGY RANGE FROM 1.0E-5 EV TO 20 MEV.
89-07 CROSS SECTIONS BELOW 9.15 EV WERE MODIFIED BY Y.KIKUCHI AND
      T.NAKAGAWA (JAERI).
94-06 JENDL-3.2.
      NU-P, NU-D AND NU-TOTAL WERE MODIFIED.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (1,452), (1,455), (1,456)
     ***********************************************************


MF=1 GENERAL INFORMATION
  MT=451 COMMENT AND DICTIONARY
  MT=452 NUMBER OF NEUTRONS PER FISSION
       SUM OF NU-P NAD NU-D.
  MT=455 DELAYED NEUTRONS PER FISSION
       AVERAGE VALUES OF SYSTEMATICS BY TUTTLE/2/, BENEDETTI ET
       AL./3/ AND WALDO ET AL./4/  DECAY CONSTANTS WERE ASSUMED
       TO BE THE SAME AS THOSE OF PU-238 EVALUATED BY BRADY AND
       ENGLAND/5/.
  MT=456 PROMPT NEUTRONS PER FISSION
       BASED ON SYSTEMATICS BY MANERO AND KONSHIN/6/, AND BY
       HOWERTON/7/.

MF=2 RESONANCE PARAMETERS
  MT=151 RESOLVED RESONANCE PARAMETERS : 1.0E-5 TO 9.15 EV
       AVERAGE CAPTURE WIDTH, SO, <D> AND R WERE ESTIMATED FROM
       SYSTEMATICS/8,9/.  THE FIRST POSITIVE RESONANCE WAS LOCATED
       AT 6.3 EV, AND ITS NEUTRON WIDTH WAS ESTIMATED FROM S0.
       THE FISSION WIDTH WAS DETERMINED SO THAT THE FISSION CROSS
       SECTION CALCULATED FROM UNRESOLVED RESONANCE FORMULA WITH
       THE FISSION WIDTH MIGHT SMOOTHLY CONNECT AT 10 KEV TO THE
       CROSS SECTION IN HIGH ENERGY REGION.  A NEGATIVE RESONANCE
       WAS ADDED AT -0.8 EV AND THE PARAMETERS WERE ADJUSTED SO AS
       TO REPRODUCE THE FISSION CROSS SECTION OF 170 B AT 0.0253
       EV/10/ AND REASONABLE CAPTURE CROSS SECTION.

               <WG>  : 0.030 EV
               R     : 9.46 FM
               <D>   : 6.3  EV
               S0    : 1.25E-4 /8,9/

       CALCULATED 2200-M/S CROSS SECTIONS AND RESONANCE INTEGRALS.
                         2200 M/SEC    RES. INTEG.
               TOTAL        331.1   B        -
               ELASTIC       16.34  B        -
               FISSION      169.4   B       58.8 B
               CAPTURE      145.4   B       401  B

MF=3 NEUTRON CROSS SECTIONS
  MT=  1 TOTAL CROSS SECTION
       OBTAINED BY OPTICAL MODEL CALCULATION.  OPTICAL POTENTIAL
       PARAMETERS WERE TAKEN FROM MURATA'S EVALUATION /11/ EXCEPT
       REAL POTENTIAL.
             ---OPTICAL POTENTIAL PARAMETERS---
               V  = 39.5-0.05*EN          (MEV)
               WS =  6.5+0.15*EN          (MEV)
               VSO=  7.0                  (MEV)
               R0 = RSO= 1.32 ,RS = 1.38 (FM)
               A  = ASO= 0.47 ,B  = 0.47 (FM)
  MT=  2 ELASTIC SCATTERING CROSS SECTION
       OBTAINED BY OPTICAL AND STATISTICAL MODEL CALCULATIONS.
  MT=4,51-54,91 INELASTIC SCATTERING CROSS SECTIONS
       OBTAINED BY OPTICAL AND STATISTICAL MODEL CALCULATIONS.
       LEVEL SCHEME WAS TAKEN FROM REF./12/ EXCEPT 4TH LEVEL OF
       WHICH ENERGY WAS BASED ON LYNN /13/.
                   NO.    EN(KEV) SPIN-PARITY
                   G.S.     0.0       0 +
                    1      44.6       2 +
                    2     145         4 +
                    3     305         6 +
                    4     523         8 +
                CONTINUUM LEVELS ASSUMED ABOVE 661 KEV.
  MT=16,17 (N,2N) AND (N,3N) CROSS SECTIONS
       CALCULATED WITH STATISTICAL MODEL BASED ON PEARLSTEIN /14/.
  MT=18,19,20,21 FISSION CROSS SECTIONS
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BELOW 10 KEV:
CALCULATED FROM THE UNRESOLVED RESONANCE FORMULA WITH THE FOLLOWING PARAMETERS.
S0 = 1.25E-4, S1 = 2.22E-4, <D> = 6.3 EV,
<WG>= 0.0415 EV. <WF> = 0.00355 EV.
ABOVE 10 KEV:
CALCULATED FROM FISSION PLATEAU CROSS SECTIONS /11,15/ AND HILL-WHEELER TYPE BARRIER PENETRATION FACTOR /16/.
FISSION BARRIER PARAMETERS WERE TAKEN FROM WEIGMANN /17/.

MT=102 CAPTURE CROSS SECTION
CALCULATED BY OPTICAL AND STATISTICAL MODEL WITH <WG> OF 41.5 MILLI-EV AND <D> OF 6.3 EV.

MT=251 MU-BAR
CALCULATED WITH OPTICAL MODEL.

MF=4 ANGULAR DISTRIBUTION OF SECONDARY NEUTRONS
MT= 2 BASED ON OPTICAL AND STATISTICAL MODEL CALCULATION.
MT=51-54 ISOTROPIC IN THE CENTER-OF-MASS SYSTEM.
MT=16-21,91 ISOTROPIC IN THE LABORATORY SYSTEM.

MF=5 ENERGY DISTRIBUTION OF SECONDARY NEUTRONS
MT=16,17,91 EVAPORATION SPECTRUM ASSUMED
MT=18,19,20,21 FISSION SPECTRUM OF MAXWELLIAN FORM ADOPTED. THETA TAKEN FROM EVALUATION OF TERRELL/18/.

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MAT number = 9434
 94-PU-238 MAPI,JAERI EVAL-MAR89 T.KAWAKITA, T.NAKAGAWA
                      DIST-SEP89 REV2-JUN94
HISTORY
79-03 NEW EVALUATION WAS MADE BY T.KAWAKITA (PNC).
89-03 RE-EVALUATION WAS MADE BY T.KAWAKITA (MAPI) AND
      T.NAKAGAWA(JAERI).
94-06 JENDL-3.2.
      NU-P, NU-D AND NU-TOTAL WERE MODIFIED.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (1,452), (1,455), (1,456)
     ***********************************************************


MF=1 GENERAL INFORMATION
  MT=451 COMMENT AND DICTIONARY
  MT=452 NUMBER OF NEUTRONS PER FISSION
       SUM OF NU-P NAD NU-D.
  MT=455 DELAYED NEUTRONS PER FISSION
       AVERAGE VALUES OF SYSTEMATICS BY TUTTLE/1/, BENEDETTI ET
       AL./2/ AND WALDO ET AL./3/  DECAY CONSTANTS WERE EVALUATED
       BY BRADY AND ENGLAND/4/.
  MT=456 PROMPT NEUTRONS PER FISSION
       THE THERMAL VALUE OF PROMPT NEUTRONS WAS BASED ON EXPERI-
       MENTAL DATA OF JAFFEY AND LERNER /5/, KROSHKIN ET AL./6/
       AND HADDAD AND ASGHER/7/.  THE ENERGY DEPENDENT TERM WAS
       ESTIMATED FROM HOWRTON'S FORMULA /8/.

MF=2  RESONANCE PARAMETERS
  MT=151  RESOLVED RESONANCE PARAMETERS FOR MLBW FORMULA.
      ENERGY RANGE IS FROM 1.0E-5 EV TO 500 EV. PARAMETERS WERE
      TAKEN FROM THE FOLLOWING EXPERIMENTAL DATA.
         49 RESONANCES ABOVE 10 EV : SILBERT /9/
          4 RESONANCES BELOW 10 EV : YOUNG /10/
      THE PARAMETERS OF TWO NEGATIVE AND 2.9-EV RESONANCES WERE
      ADJUSTED TO THE THERMAL CROSS SECTIONS/11/.

      CALCULATED 2200-M/S CROSS SECTIONS AND RESONANCE INTEGRALS
                      2200-M/S           RES. INTEG.
          TOTAL        586.7  B              -
          ELASTIC       28.53 B              -
          FISSION       17.89 B            32.7 B
          CAPTURE      540.3  B           154   B

MF=3  NEUTRON CROSS SECTIONS

  THE ENERGY REGION BELOW 500 EV IS THE RESONANCE REGION.  ABOVE
  500 EV, THE CROSS SECTIONS WERE EVALUATED AS FOLLOWS.

  MT=1,2,4,51-78,91,102  TOTAL, ELASTIC AND INELASTIC SCATTERING,
                         AND CAPTURE CROSS SECTIONS
      CALCULATED WITH OPTICAL AND STATISTICAL MODELS.  CASTHY/12/
      WAS USED FOR THE CALCULATION.

      OPTICAL POTENTIAL PARAMETERS:
        THE REAL POTENTIAL WAS ADJUSTED SO AS TO OBTAINED THE
        REASONABLE COMPOUND NUCLEUS FORMATION CROSS SECTION.  THE
        OTHER PARAMETERS WERE TAKEN FROM MURATA'S EVALUATION /13/.
           V  = 38.8 - 0.05*EN          (MEV)
           WS = 6.5 + 0.15*EN           (MEV)
           VSO= 7.0                     (MEV)
           A  = B  = ASO= 0.47          (FM)
           R  = RSO= 1.32               (FM)
           RS = 1.52                    (FM)

      THE LEVEL SCHEME:
        TAKEN FROM REF. /14/.
              NO.      ENERGY(KEV)   SPIN-PARITY
              G.S.         0.0          0 +
               1          44.08         2 +
               2         145.98         4 +
               3         303.4          6 +
               4         514.0          8 +
               5         605.1          1 -
               6         661.4          3 -
               7         763.2          5 -
               8         941.5          0 +
               9         962.77         1 -
              10         968.2          2 -
              11         983.0          2 +
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12	985.5	2 -
13	1028.55	2 +
14	1069.95	3 +
15	1082.57	4 -
16	1125.8	4 +
17	1174.5	2 +
18	1202.7	3 -
19	1228.6	0 +
20	1264.2	2 +
21	1310.3	2 +
22	1426.6	0 +
23	1447.3	1 -
24	1458.5	2 +
25	1560.0	1 -
26	1596.5	2 +
27	1621.4	1 -
28	1636.6	1 -

CONTINUUM LEVELS ASSUMED ABOVE 1.65 MEV.
THE LEVEL DENSITY PARAMETERS OF GILBERT AND CAMERON /15/.
THE FISSION, (N,2N) AND (N,3N) CROSS SECTIONS WERE TAKEN INTO ACCOUNT AS THE COMPETING PROCESSES. FOR THE CAPTURE CROSS SECTION, THE GAMMA-RAY STRENGTH FUNCTION WAS ESTIMATED FROM D-OBS = 9.5EV AND AVERAGE RADIATIVE WIDTH = 0.04 EV.

MT=16,17 (N,2N) AND (N,3N) REACTION CROSS SECTIONS
CALCULATION BASED ON THE PEARLSTEIN'S METHOD /16/.
MT=18 FISSION CROSS SECTION
EVALUATED MAINLY ON THE BASIS OF DATA MEASURED BY BUDTZ-JORGENSEN/17/. OTHER EXPERIMENTS /9, 18, 19, 20, 21, 22, 23, 24, 25/ WERE ALSO TAKEN INTO CONSIDERATION.
MT=251 MU-BAR
CALCULATED WITH OPTICAL MODEL.

MF=4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=2,51-78,91
CALCULATED WITH OPTICAL MODEL.
MT=16,17,18
ISOTROPIC IN THE LABORATORY SYSTEM.

MF=5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=16,17,91
EVAPORATION SPECTRUM WAS ASSUMED.
MT=18
MAXWELLIAN TYPE FISSION SPECTRUM. TEMPERATURE WAS ESTIMATED FROM Z**2/A SYSTEMATICS BY SMITH ET AL. /26/.

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MAT number = 9437

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 94-PU-239 NAIG       EVAL-MAR87 M.KAWAI, T.YOSHIDA, K.HIDA
                      DIST-SEP89 REV2-FEB93
HISTORY
87-03 EVALUATION WAS MADE BY
        M.KAWAI AND K.HIDA(NAIG) :  CROSS SECTIONS ABOVE
                      RESONANCE REGION AND OTHER QUANTITIES,
        T.YOSHIDA(NAIG) : RESONANCE PARAMETERS AND BACKGROUND
                      CROSS SECTIONS.
      DATA WERE COMPILED BY T.NAKAGAWA (JAERI).
88-08 PARTLY MODIFIED.
       NU-BAR, RESOLVED RESONS., (N,2N).
89-02 FP YIELDS WERE TAKEN FROM JNDC FP DECAY DATA FILE VERSION-2.
89-03 UNRESOLVED RESONANCE PARAMETERS WERE SLIGHTLY MODIFIED.
93-02 JENDL-3.2.
      RESONANCE PARAMETERS EVALUATED BY H.DERRIEN (JAERI)/1/.
      FISSION SPECTRA CALCULATED BY T.OHSAWA (KINKI UNIV.)
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)       RESOLVED RESONANCE PARAMETERS UP TO 2.5 KEV
      (5,18)
     ***********************************************************


MF=1  GENERAL INFORMATION
  MT=451  DESCRIPTIVE DATA AND DICTIONARY
  MT=452  NUMBER OF NEUTRONS PER FISSION
     SUM OF NU-P (MT=456) AND NU-D (MT=455).
  MT=455  DELAYED NEUTRON DATA
     EVALUATED DATA BY TUTTLE /2/ WERE ADOPTED.
  MT=456  NUMBER OF PROMPT NEUTRONS PER FISSION
     STANDARD CF-252 SF NU-P WAS TAKEN TO BE 3.756.  THERMAL NU-P
     WAS 2.8781 THAT WAS A MEAN VALUE OF EXPERIMENTAL DATA.  THE
     ENERGY DEPENDENT NU-P WAS OBTAINED FROM
         BELOW 10 EV      : REF./3/ MULTIPLIED BY 1.001
         10 EV <EN< 500 EV: REF./4/ MULTIPLIED BY 1.0035
         500EV <EN< 100KEV: REF./3/ MULTIPLIED BY 1.001
         ABOVE 500 KEV    : REFS./5,6,7,8,9/
     FACTORS ARE RATIOS OF 2.8781 AND THE EXPERIMENTS AT THERMAL
     ENERGY.

MF=2  RESONANCE PARAMETERS
  MT=151 RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
   RESOLVED RES. PARAMETERS FOR REICH-MOORE FORMULA: UP TO 2.5 KEV
      PARAMETERS WERE TAKEN FROM REF./1/ DETAILS OF EVALUATION
      ARE GIVEN IN APPENDIX.
   UNRESOLVED RESONANCES : FROM 2.5 TO 30 KEV.
      THE ENERGY DEPENDENT S0, S1 AND FISSION WIDTH WERE DETER-
      MINED SO AS TO REPRODUCE THE EVALUATED TOTAL, CAPTURE AND
      FISSION CROSS SECTIONS.

   2200-M/SEC CROSS SECTIONS AND CALCULATED RESONANCE INTEGRALS.
                       2200 M/S          RES. INTEG.
         TOTAL       1025.7   B             -
         ELASTIC        7.970 B             -
         FISSION      747.4   B           302.6 B
         CAPTURE      270.3   B           181.6 B

MF=3  NEUTRON CROSS SECTIONS
     BELOW 2.5 KEV, CROSS SECTIONS WERE REPRESENTED WITH THE
     RESOLVED RESONANCE PARAMETERS.  BETWEEN 2.5 AND 30 KEV, CROSS
     SECTIONS WERE REPLACED WITH UNRESOLVED RESONANCE PARAMETERS.

  MT=1  TOTAL
     BELOW 7 MEV, JENDL-2 EVALUATION WHICH WERE BASED ON THE
     EXPERIMENTS OF REFS./10,11,12,13,14/ WAS ADOPTED.  ABOVE
     7 MEV, EXPERIMENTAL DATA BY POENITZ /15/ WERE ADOPTED.

  MT=2  ELASTIC SCATTERING
     CALCULATED AS (TOTAL) - (PARTIAL CROSS SECTIONS).

  MT=4, 51-68, 91 INELASTIC SCATTERING
     THE DIRECT COMPONENT WAS CALCULATED WITH COUPLED CHANNEL CODE
     ECIS /16/.  EIGHT STATES, MARKED WITH AN ASTERISK IN THE
     LEVEL SCHEME GIVEN BELOW, OF THE GROUND STATE ROTATIONAL BAND
     WERE COUPLED IN THE CALCULATION. DEFORMED OPTICAL POTENTIAL
     PARAMETERS WITH A DERIVATIVE WOODS-SAXON ABSORPTION TERM WERE
     TAKEN FROM REF./17/:
        V    =46.2 - 0.3*EN        (MEV)
        WV   =-1.2 + 0.15*EN       (MEV),   EN > 8 MEV
        WS   = 3.6 + 0.4*EN        (MEV),   EN < 7 MEV
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              6.4 + 0.1*(EN-7)     (MEV),   EN > 7 MEV
       VSO  = 6.2                  (MEV)
       R: RV = 1.26 ,  RS= 1.24     RSO= 1.12 (FM)
       A: AV = 0.615,  AS= 0.50 ,  ASO= 0.47 (FM)
       BETA-2= 0.21,  BETA-4= 0.065
    THE COMPOUND COMPONENT WAS CALCULATED WITH OPTICAL AND
    STATISTICAL MODEL CODE CASTHY /18/, TAKING INTO ACCOUNT
    LEVEL FLUCTUATION AND INTERFERENCE EFFECTS. THE FISSION,
    (N,2N), (N,3N), AND (N,4N) REACTIONS WERE CONSIDERED AS
    COMPETING PROCESSES.

    THE NEUTRON TRANSMISSION COEFFICIENTS FOR THE INCIDENT
    CHANNEL WERE GENERATED WITH ECIS, WHEREAS THOSE FOR THE EXIT
    CHANNEL WERE CALCULATED WITH CASTHY USING SPHERICAL OPTICAL
    POTENTIAL PARAMETERS ADOPTED FOR JENDL-2 EVALUATION:
       V  = 40.72 - 0.05*EN        (MEV)
       WS = 6.78 - 0.29*EN         (MEV)
       VSO= 7.0                    (MEV)
       R  = RSO= 1.32, RS =1.357  (FM)
       A  = ASO= B = 0.47          (FM)
    THE SURFACE ABSORPTION IS OF DERIVATIVE WOODS-SAXON TYPE.
    THE LEVEL SCHEME WAS TAKEN FROM REF./19/:
           NO.      ENERGY(KEV)   SPIN-PARITY COUPLED LEVEL
           G.S.         0.0          1/2 +         *
            1           7.86         3/2 +         *
            2          57.28         5/2 +         *
            3          75.71         7/2 +         *
            4         163.76         9/2 +         *
            5         194.          11/2 +         *
            6         285.46         5/2 +
            7         317.          13/2 +         *
            8         330.13         7/2 +
            9         360.          15/2 +         *
           10         387.41         9/2 +
           11         391.6          7/2 -
           12         435.           9/2 -
           13         462.          11/2 +
           14         469.8          1/2 -
           15         488.          11/2 -
           16         492.1          3/2 -
           17         505.5          5/2 -
           18         511.84         7/2 +

    CONTINUUM LEVELS WERE ASSUMED ABOVE 538 KEV.

 MT= 16, 17, 37    (N,2N), (N,3N), AND (N,4N)
    CALCULATED WITH A MODIFIED VERSION OF GNASH /20/.  THE
    NEUTRON TRANSMISSION COEFFICIENTS WERE GENERATED WITH ECIS
    /16/ AND OPTICAL MODEL CODE ELIESE-3 /21/, RESPECTIVELY,
    USING THE ABOVE-MENTIONED DEFORMED AND SPHERICAL POTENTIALS.
    THE LEVEL SCHEMES FOR PU-236, -237, -238, -239 AND -240 WERE
    TAKEN FROM REFS. /19,22,23,24,25/.  THE GILBERT-CAMERON'S
    COMPOSITE FORMULA /26/ WAS USED TO REPRESENT THE LEVEL
    DENSITY.  LEVEL DENSITY PARAMETERS WERE DETERMINED FROM THE
    OBSERVED S-WAVE RESONANCE SPACING /27/ AND THE LEVEL SCHEMES.
    THE SPIN CUT-OFF FACTORS IN THE CONSTANT TEMPERATURE MODEL
    WERE REPRESENTED BY GRUPPELAAR'S PRESCRIPTION /28/.

                  PU-236     PU-237     PU-238     PU-239     PU-240
    A    (1/MEV)  25.50       28.00     26.23       29.44     26.96
    T      (MEV)   0.442       0.416     0.422       0.398     0.412
    C    (1/MEV)   3.06      14.5        2.88      15.0        3.30
    E-JOINT(MEV)   4.71        4.09      4.38        3.97      4.26
    SIGMA**2       8.63        8.18      6.47      11.6        9.69
    NO. LEVELS     4.0       19.0       22.0       19.0       28.0
    E-MAX (MEV)    0.307       0.4735    1.3103      0.5118    1.2621
    D-OBS  (EV)    0.395     10.7        0.383       9.0       2.3
    GAMMA-G(EV)    0.043       0.027     0.043       0.034     0.043

    D-OBS OF PU-236, -237 AND -238 WERE NOT AVAILABLE FROM REF.
    /27/, AND HENCE THE PARAMETERS "A" FOR THESE NUCLEI WERE
    DETERMINED ASSUMING ITS LINEAR DEPENDENCE ON THE MASS A:
        A = 0.365*A - 60.64      FOR EVEN-EVEN PU ISOTOPES
        A = 0.659*A - 128.18     FOR ODD-MASS PU ISOTOPES
    WHICH WERE DERIVED BY ANALYZING THE DATA OF PU-241, -242,
    -243, AND -244 AS WELL AS PU-239 AND -240. LOW-LYING LEVELS
    WERE HARDLY OBSERVED FOR PU-236 AND IT WAS ASSUMED TO BE
    IDENTICAL TO THAT OF PU-238 TO DETERMINE THE CONSTANT
    TEMPERATURE PARAMETERS.

    EVALUATED FISSION CROSS SECTION DESCRIBED BELOW WAS FED TO
    GNASH AS A COMPETING PROCESS/29/.  THE PREEQUILIBRIUM PROCESS
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     WAS TAKEN INTO ACCOUNT.  THOUGH THE PARAMETER F2 WAS
     ADJUSTED, THE CALCULATED (N,2N) CROSS SECTION FAILED TO WELL
     REPRODUCE THE MEASURED DATA.  THEREFORE, THE MEASURED (N,2N)
     CROSS SECTION OF FREHAUT ET AL./30/ WAS ADOPTED IN PLACE OF
     THE CALCULATED ONE.

  MT=18    FISSION
     BELOW  50 KEV
        BASED ON MEASUREMENTS OF REF./31/ AND REF./32/.
     ABOVE  50 KEV
        SIMULTANEOUS EVALUATION WAS PERFORMED BY KANDA ET AL./33/

  MT=102  CAPTURE
     THE CROSS SECTION IN THE ENERGY RANGE BELOW 1 MEV WAS DERIVED
     AS A PRODUCT OF THE EVALUATED FISSION CROSS SECTION AND ALPHA
     VALUE. THE ALPHA VALUES ARE IDENTICAL TO THOSE OF JENDL-2.
     ABOVE 1 MEV THE RESULTS OF THE STATISTICAL MODEL CALCULATION
     WITH CASTHY /18/ LINKED WITH ECIS /16/ WERE ADOPTED. THE
     PHOTON STRENGTH FUNCTION WAS NORMALIZED IN THE CASTHY
     CALCULATION SO AS TO REPRODUCE THE CAPTURE CROSS SECTION OF
     280 MB AT 100 KEV.

  MT=251  MU-BAR
     CALCULATED WITH OPTICAL MODEL.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,51-68,91     CALCULATED WITH ECIS /16/ AND CASTHY /18/.
  MT=16,17,18,37    ISOTROPIC IN THE LABORATORY SYSTEM.

MF=5  ENERGY DISTRIBUTIONS SECONDARY NEUTRONS
  MT=16,17,37,91
     CALCULATED WITH THRESHOLD CROSS SECTION CALCULATION CODE
     PEGASUS /34/ ON THE BASIS OF PREEQUILIBRIUM AND MULTI-STEP
     EVAPORATION MODEL.
  MT=18
     DISTRIBUTIONS WERE CALCULATED WITH THE MODIFIED MADLAND-NIX
     MODEL/35,36/.  THE COMPOUND NUCLEUS FORMATION CROSS SECTIONS
     FOR FISSION FRAGMENTS (FF) WERE CALCULATED USING BECCHETTI-
     GREENLEES POTENTIAL/37/.  UP TO 4TH-CHANCE-FISSION WERE
     CONSIDERED AT HIGH INCIDENT NEUTTRON ENERGIES.  THE IGNATYUK
     FORMULA/38/ WERE USED TO GENERATE THE LEVEL DENSITY PARAME-
     TERS.
       PARAMETERS ADOPTED:
           TOTAL AVERAGE FF KINETIC ENERGY = 176.02 - 177.87 MEV
           AVERAGE ENERGY RELEASE          = 198.088 MEV
           AVERAGE MASS NUMBER OF LIGHT FF = 101
           AVERAGE MASS NUMBER OF HEAVY FF = 139
           LEVEL DENSITY OF THE LIGHT FF   = 10.269 - 11.59
           LEVEL DENSITY OF THE HEAVY FF   = 11.124 - 12.27
           RATIO OF NUCLEAR TEMPERATURE
                     FOR LIGHT TO HEAVY FF = 0.85
       NOTE THAT THE PARAMETERS VARY WITH THE INCIDENT ENERGY
       WITHIN THE INDICATED RANGE.
  MT=455
     TAKEN FROM SAPHIER ET AL./39/

MF=8  FISSION PRODUCT YIELDS
  MT=454  INDEPENDENT YIELDS
  MT=459  CUMULATIVE YIELDS
     BOTH WERE TAKEN FROM JNDC FP DECAY DATA FILE VERSION-2/40/.

MF=12  PHOTON PRODUCTION MULTIPLICITIES AND TRANSITION
       PROBABILITY ARRAYS
  MT=16,17,37,91,102   (N,2N),(N,3N),(N,4N),INELASTIC SCATTERING
                          TO THE CONTINUUM, AND CAPTURE
      DATA CALCULATED WITH GNASH /20/ WERE STORED UNDER OPTION-1
      (MULTIPLICITIES).  THE PHOTON BRANCHING DATA WERE TAKEN FROM
      REFS. /19/ AND /22,23,24,25/.  SOME ASSUMPTIONS WERE MADE
      FOR LEVELS OF PU-237 AND -239 WHICH HAD NO INFORMATION ON
      BRANCHING: IF E1 TRANSITIONS WERE ALLOWED TO LOWER LEVELS,
      THE TRANSITION PROBABILITIES WERE EQUALLY SHARED AMONG THEM.
      IF NOT, EQUALLY SHARED COLLECTIVE E2 TRANSITIONS WERE
      ASSUMED.  THE PHOTON STRENGTH FUNCTIONS WERE REPRESENTED BY
      THE BRINK-AXEL TYPE GIANT DIPOLE RESONANCE WITH CONVENTIONAL
      RESONANCE POSITIONS AND WIDTHS.  THEY WERE NORMALIZED TO
      INPUT VALUES AT THE THERMAL ENERGY.  THE PYGMY RESONANCE WAS
      INTRODUCED ONLY FOR PU-240.  THE PARAMETERS WERE ASSUMED TO
      BE THE SAME AS THOSE OF U-238 /41/.

  MT=18    FISSION
      STORED UNDER OPTION-1 (MULTIPLICITIES).  THE THERMAL NEUTRON
      INDUCED FISSION GAMMA SPECTRUM MEASURED BY VERBINSKI /42/
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      WAS ADOPTED AND USED UP TO 20 MEV NEUTRON.  SINCE NO DATA
      WERE GIVEN FOR THE PHOTONS BELOW 0.14 MEV, IT WAS ASSUMED TO
      BE THE SAME AS THAT OF THE PHOTONS BETWEEN 0.14 AND 0.3 MEV.

  MT=51-68  INELASTIC SCATTERING
      STORED UNDER OPTION-2 (TRANSITION PROBABILITY ARRAYS).  DATA
      WERE TAKEN FROM REF./19/, AND THE SAME ASSUMPTIONS AS
      DESCRIBED ABOVE WERE APPLIED TO THE LEVELS TO WHICH NO DATA
      WERE GIVEN.

MF=14  PHOTON ANGULAR DISTRIBUTIONS
    MT=16,17,18,37,51-68,91,102     ISOTROPIC.

MF=15  CONTINUOUS PHOTON ENERGY SPECTRA
    MT=16,17,37,91,102      CALCULATED WITH GNASH /20/
    MT=18                   EXPERIMENTAL DATA BY VERBINSKI /42/
                            WERE ADOPTED.
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APPENDIX          RESONANCE DATA
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THE PRESENT FILE CONTAINS THE RESONANCE PARAMETERS OBTAINED FROM A SAMMY FIT ANALYSIS OF HIGH RESOLUTION EXPERIMENTAL DATA, PERFORMED AT ORNL(OAK RIDGE NATIONNAL LABORATORY,USA) BY H.DERRIEN AND G.DE SAUSSURE AND AT JAERI(TOKAI-MURA RESEARCH ESTABLISHMENT, JAPAN) BY H.DERRIEN.

THE FILE CONTAINS THREE INDEPENDANT SECTIONS:

1/ THE FIRST CORRESPONDS TO THE ENERGY RANGE 0 KEV TO 1 KEV. THE CORRESPONDING SET OF RESONANCE PARAMETRES CONTAINS 398 RESONANCES IN THE ENERGY RANGE 0 KEV TO 1 KEV, 4 FICTICIOUS NEGATIVE ENERGY RESONANCES AND 3 FICTICIOUS RESONANCES ABOVE 1 KEV;

2/ THE SECOND CORRESPONDS TO THE ENERGY RANGE 1 KEV TO 2 KEV. THE CORRESPONDING SET OF RESONANCE PARAMETERS CONTAINS 435 RESONANCES IN THE ENERGY RANGE 0.980 KEV TO 2.02 KEV, 3 FICTICIOUS RESONANCES BELOW 0.9 KEV AND 3 FICTICIOUS RESONANCES ABOVE 2.02

KEV;
3/ THE THIRD CORRESPONDS TO THE ENERGY RANGE 2 KEV TO 2.5 KEV. THE CORRESPONDING SET OF RESONANCE PARAMETERS CONTAINS 218 RESONANCES IN THE ENERGY RANGE 1.98 KEV TO 2.53 KEV, 3 FICTICIOUS RESONANCES BELOW 1.98 KEV AND 3 FICTICIOUS RESONANCES ABOVE 2.53 KEV.

IN ALL SECTIONS THE FICTICIOUS RESONANCE PARAMETERS TAKE INTO ACCOUNT THE CONTRIBUTION OF ALL THE EXTERNAL TRUNCATED RESONANCES IN SUCH A WAY THAT NO TOTAL, SCATTERING, FISSION AND CAPTURE SMOOTH FILES ARE NEEDED IN THE CORRESPONDING ENERGY RANGES FOR THE REPRODUCTION OF THE CROSS SECTIONS WITHIN THE EXPERIMENTAL ERRORS.

THE FOLLOWING EXPERIMENTAL DATA BASE HAS BEEN USED IN THE SAMMY FITS:

- -ABSORPTION AND FISSION FROM R.GWIN ET AL./1,2/;
- -FISSION FROM R.GWIN ET AL./3,4/, J.BLONS/5/, L.W.WESTON ET AL./6,7/;
- -TRANSMISSION FROM R.R.SPENCER ET AL./8/, J.A.HARVEY ET AL./9/

PRIOR TO THE FITS THE EXPERIMENTAL FISSION AND ABSORPTION CROSS SECTIONS WERE NORMALISED, DIRECTLY OR INDIRECTLY TO THE 0.0253 EV VALUES OBTAINED BY THE ENDF/B-VI STANDARD EVALUATION GROUP/10/. THE TRANSMISSION DATA WERE CONSIDERED AS ACCURATE ABSOLUTE MEASUREMENTS(R.R.SPENCER TOTAL CROSS SECTION AT 0.0253 EV IS 1025.0 B IN EXCELLENT AGREEMENT WITH THE 1027.3 B STANDARD VALUE).

DETAILS ON THE ANALYSIS ARE FOUND IN REFERENCES/11,12,13/

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COMMENTS ON THE THERMAL AND LOW ENERGY RANGES

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THE THERMAL CROSS SECTION VALUES CALCULATED AT 293 K BY THE RESONANCE PARAMETERS OF THE FIRST SECTION ARE GIVEN IN THE FOLLOWING TABLE:

	SAMMY 293 K (BARN)	RESENDD 293 K (BARN)	PROPOSED STANDARD VALUES(BARN)/10/
FISSION	747.64	747.90	747.99+-1.87
CAPTURE	271.10	270.73	271.43+-2.14
SCATTERING	7.97	7.99	7.88+-0.97
TOTAL	1026.71	1026.62	1027.30+-5.00

ONE SHOULD NOTE THAT THE 293 K CROSS SECTIONS CALCULATED AT 0.0253 EV DEPEND ON THE WAY THE DOPPLER BROADENING CALCULATION IS PERFORMED. FOR INSTANCE USING A GAUSSIAN BROADENING FUNCTION WILL GIVE A FISSION CROSS SECTION ABOUT 2.5 BARNS LARGER THAN THE ONE OBTAINED FROM THE ACCURATE CALCULATION WHICH CONSERVES THE 1/V SHAPE OF THE THERMAL CROSS SECTION. THE VALUES GIVEN IN THE TABLE ABOVE WERE OBTAINED FROM SAMMY (LEAL-HWANG METHOD)/14,15/ AND FROM RESENDD WITH 0.1% FOR THE INTERPOLATION ACCURACY/16/.

THE FOLLOWING TABLE SHOWS EXPERIMENTAL CROSS SECTIONS AVERAGED OVER THE ENERGY RANGES 0.02 EV TO 0.06 EV AND 0.02 EV TO 0.65 EV, COMPARED TO THE CALCULATED VALUES:

AVERAGE CROSS-SECTIONS(BARN)

REFERENCES(1-10)	0.02 TO 0.06 EV EXP	0.02 TO 0.06 EV CALC (293K)	0.02 TO 0.65 EV EXP	0.02 TO 0.65 EV CALC (293K)
GWIN71 FISS	631.41		843.71	
GWIN76 FISS	631.41		838.39	
GWIN84 FISS(*)	631.41	631.75(+0.05%)	837.18	838.69(+0.18%)
DERUYTER70 FISS	631.41		859.43	
WAGEMANS80 FISS	631.41		862.56	
WAGEMANS88 FISS	631.41		841.80	
GWIN71 CAPTURE	243.84	243.22(-0.25%)	524.75	518.13(-1.26%)
GWIN76 ABSORPT(*)	875.90	874.29(-0.18%)	1359.96	1357.14(-0.21%)
SPENCER84 TOT(*)	883.20	882.86(-0.04%)	1361.69	1367.6 (+0.43%)

(*)THESE DATA HAD THE LARGIEST WEIGHT IN THE THERMAL FIT. THE VALUES BETWEEN THE PARENTHESES GIVE THE PERCENTAGE DEVIATION BETWEEN THE CALCULATED DATA AND THE EXPERIMENTAL DATA.

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THE VALUE OF 631.4 BARNS FOR ALL THE AVERAGED EXPERIMENTAL FISSION CROSS SECTIONS IN THE ENERGY RANGE 0.02 EV TO 0.06 EV CORRESPONDS TO THE RENORMALISATION OF THE FISSION EXPERIMENTS TO 748.0+-1. BARNS AT 0.0253 EV. ORNL DATA ARE CONSISTENT WITHIN 0.8% OVER THE ENERGY RANGE 0.02 EV TO 0.65 EV (I.E. OVER THE 0.3 EV RESONANCE). DERUYTER 1970 AND WAGEMANS 1980 DATA ARE ABOUT 2.5%

LARGER AND WERE NOT INCLUDED IN THE SAMMY FIT. WHEN NORMALIZED ON THE STANDARD VALUE AT 0.0253 EV, GWIN 76 ABSORPTION AGREES WITH THE ABSORPTION OBTAINED FROM SPENCER TOTAL CROSS SECTION WITHIN 0.7% OVER THE 0.3 EV RESONANCE. THE PRESENT EVALUATION IS ESSENTIALLY THE RESULT OF A CONSISTENT SAMMY ANALYSIS OF ALL THE AVAILABLE ORNL DATA WITH A LARGER WEIGHT ON GWIN 1984 FISSION, GWIN 1976 ABSORPTION AND SPENCER TRANSMISSION DATA.

AFTER RENORMALIZATION OF THE CALCULATED FISSION CROSS SECTION ON THE PRELIMINARY 1991 WESTON AND TODD FISSION DATA(SEE NEXT SECTION) A SLIGHT ADJUSTMENT OF THE NEGATIVE RESONANCE PARAMETERS WAS PERFORMED TO KEEP THE VALUES CALCULATED AT 0.0253 EV IN CLOSE AGREEMENT WITH THE STANDARD VALUES. THE 1988 DATA OF WAGEMANS ET AL./17/ AGREE WITHIN 0.4% WITH THE CALCULATED VALUES OVER THE ENERGY RANGE FROM 0.02 EV TO 0.65 EV AFTER ADJUSTMENT OF THE ENERGY SCALE TO THE ORNL SCALE (THE DIFFERENCE WAS 0.27 EV AT 20 EV BETWEEN 1988 WAGEMANS AND ORNL SAMMY FIT ENERGY SCALES).

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COMMENTS ON THE 0 KEV TO 1 KEV ENERGY RANGE.
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AT THE END OF 1987, AN ANALYSIS WAS COMPLETED UP TO 1 KEV. IN A PRELIMINARY STEP, A CORRELATED FIT OF HARVEY TRANSMISSION DATA, WESTON 84 FISSION DATA AND BLONS FISSION DATA WAS PERFORMED, WITH POSSIBLE ADJUSTMENT OF THE NORMALIZATION COEFFICIENTS AND OF THE BACKGROUND CORRECTIONS. THIS PRELIMINARY STEP HAS SHOWN THAT THIS ADJUSTMENT WAS NOT NECESSARY TO HAVE CONSISTENCY BETWEEN HARVEY DATA AND WESTON DATA. BLONS DATA NEEDED A LARGE READJUSTMENT OF THE BACKGROUND AND OF THE NORMALIZATION. THEREFORE, THE FINAL FIT WAS PERFORMED ONLY ON HARVEY TRANSMISSION DATA, GWIN 84 FISSION DATA (BELOW 30 EV) AND WESTON 84 FISSION DATA, WITH NO BACKGROUND AND NORMALISATION ADJUSTMENT. BLONS DATA, WHICH HAVE BETTER RESOLUTION THAN WESTON 84 DATA, WERE USED ONLY TO OBTAIN MORE ACCURATE FISSION WIDTHS OF SOME NARROW RESONANCES IN THE HIGH ENERGY RANGE.

IN 1989, PRELIMINARY RESULTS OF THE 1988 WESTON FISSION MEASUREMENT/7/ WERE INCLUDED IN THE SAMMY EXPERIMENTAL DATA BASE. ONE EXPECTED FROM THIS MEASUREMENT, WHICH WAS PERFORMED BY USING A 86 M FLIGHT PATH WITH A RESOLUTION COMPARABLE TO THE RESOLUTION OF HARVEY TRANSMISSION, A CONFIRMATION OF THE EXCELLENT QUALITY OF THE 1984 MEASUREMENT. A CONSISTENT SAMMY FIT OF HARVEY TRANSMISSION, WESTON 84 FISSION AND PRELIMINARY WESTON 88 FISSION WAS RESTARTED FROM THE PARAMETER AND COVARIANCE FILES OBTAINED IN 1987. IT APPEARED THAT LARGE BACKGROUND AND NORMALISATION CORRECTIONS WERE NEEDED ON THE NEW WESTON FISSION TO OBTAIN CONSISTENCY WITH HARVEY TRANSMISSION DATA. THESE CORRECTIONS WERE COMPARABLE TO THOSE FOUND ON BLONS DATA AND WERE NOT UNDERSTOOD BY THE AUTHORS OF THE EXPERIMENT. THE LAST SAMMY RUNS WERE PERFORMED BY NOT ALLOWING BACKGROUND AND NORMALIZATION VARIATIONS ON HARVEY TRANSMISSION AND WESTON 84 FISSION(VERY SMALL ERROR BARS WERE ASSIGNED TO THE CORRESPONDING PARAMETERS IN THE COVARIANCE MATRIX) AND BY ALLOWING THESE VARIATIONS ON WESTON 88 DATA. A NEW SET OF RESONANCE PARAMETERS WAS OBTAINED,WHICH WAS IMPROVED COMPARED TO THE PREVIOUS SET DUE TO THE VERY HIGH RESOLUTION OF THE NEW WESTON FISSION MEASUREMENT.

THE CALCULATED AVERAGE FISSION CROSS SECTION IN THE ENERGY RANGE FROM 0.1 KEV TO 1.0 KEV WAS 3.7% SMALLER THAN THE VALUES OBTAINED BY THE ENDF/B-VI STANDARD EVALUATION GROUP, DUE TO THE FACT THAT WESTON 84 DATA WERE 3.1% LOWER THAN THE AVERAGE STANDARD VALUE. A NEW MEASUREMENT WAS PERFORMED BY WESTON AND TODD IN 1991 /18/ IN ORDER TO CHECK THEIR 1984 DATA. A CAREFUL NORMALIZATION OF THE DATA IN THE THERMAL ENERGY RANGE SHOWED THAT THE 1984 DATA SHOULD BE RENORMALIZED BY ABOUT +3%. TO TAKE INTO ACCOUNT THIS RENORMALIZATION, THE 1989 RESONANCE PARAMETERS WERE MODIFIED AT JAERI/13/ IN THE FOLLOWING WAY:

1/ INCREASE OF THE FISSION WIDTH BY 3% AND DECREASE OF THE CAPTURE WIDTH BY A QUANTITY EQUAL TO THE VARIATION OF THE FISSION WIDTH, IN THE NARROW RESONANCES(MAINLY 1+ RESONANCES); THAT DOES NOT MODIFY THE TOTAL CROSS SECTION IN THE CORRESPONDING RESONANCES;

2/ ADJUSTMENT OF THE NEUTRON WIDTH OF THE 0+ RESONANCES BY A REFIT OF THE TRANSMISSION DATA AND OF THE RENORMALIZED WESTON AND TODD 1984 DATA IN ENERGY RANGES WHERE THE CONTRIBUTION OF THE 0+ RESONANCES IS DOMINANT, AND INCREASE OF THE OTHER(SMALL) 0+ NEUTRON WIDTHS BY 3%. NO SEVERE INCONSISTENCY WAS OBSERVED BETWEEN THE TRANSMISSION DATA AND THE NEW FISSION DATA OVER THE DOMINANT 0+ RESONANCES;THE DIFFERENCES BETWEEN THE 1989 FITS OF THE TRANS-MISSION AND THE NEW FITS WERE CONSISTENT WITHIN THE EXPERIMENTAL ERROR BARS.

THE FOLLOWING TABLE SHOWS THE FISSION CROSS SECTIONS CALCULA-TED FROM THE RESONANCE PARAMETERS, THE EXPERIMENTAL VALUES AND THE RESULTS OF THE ENDF/B-VI STANDARD EVALUATION GROUP AVERAGED IN THE

SAME ENERGY INTERVALS. WESTON 1991 DATA ARE PRELIMINARY. WESTON 1984 DATA ARE NORMALIZED ON PRELIMINARY WESTON 1991:

ENERGY (EV)	CALCUL	WESTON 1991	WESTON 1984	STANDARD
	CROSS-SECTIONS(BARN)			
0.010-10.	80.12	79.98		
9-20	94.74	94.91		
20-40	17.52	17.76	17.97	
40-60	50.64	50.90	50.87	
60-100	54.42	54.38	54.33	
100-200	18.63	18.59	18.56	18.66
200-300	17.85		17.89	17.88
300-400	8.31		8.34	8.43
400-500	9.59		9.58	9.57
200-500	11.92	11.93	11.93	11.96
500-600	15.39		15.57	15.86
600-700	4.37		4.30	4.46
700-800	5.51		5.53	5.63
800-900	4.84		4.89	4.98
900-1000	8.33		8.38	8.30
500-1000	7.69	7.73	7.73	7.79
20-1000	13.09	13.11	13.11	

GWIN 1971 AND 1976 ABSORPTION DATA WERE NOT INCLUDED IN THE SAMMY FIT IN THE ENERGY RANGE ABOVE 1 EV. ACCURATE ABSORPTION CROSS SECTIONS SHOULD BE CALCULATED FROM THE PARAMETERS OBTAINED FROM THE ANALYSIS OF THE TRANSMISSION AND FISSION DATA. THE FOLLOWING TABLE SHOWS THE CALCULATED AVERAGE VALUES OF THE CAPTURE, ABSORPTION AND ALPHA COMPARED TO GWIN 1971 AND GWIN 1976 DATA. THE CALCULATIONS WERE PERFORMED WITH RESENDD, 1.0 % ACCURACY:

ENERGY(EV)	CALC. VALUES (293K) CAPT	ABSORP	ALPHA	GWIN DATA ABSORP	ALPHA
	CROSS-SECTIONS(BARN)				
7.3- 16.0	76.61	196.04	0.64	208.00	0.74(*)
16.0- 37.5	20.51	44.55	0.85	46.50	0.89(*)
37.5- 50.0	48.72	70.00	2.29	83.15	2.96(*)
50.0-100.0	33.60	92.13	0.57	92.84	0.63
100.0-200.0	15.58	34.29	0.83	33.66	0.87
200.0-300.0	15.85	33.68	0.89	34.69	0.94
300.0-400.0	9.69	18.01	1.16	18.31	1.16
400.0-500.0	3.96	13.56	0.41	13.56	0.44
500.0-600.0	10.87	26.30	0.70	26.54	0.72
600.0-700.0	6.53	10.90	1.49	11.57	1.54
700.0-800.0	4.95	10.47	0.90	10.52	0.97
800.0-900.0	3.65	8.50	0.75	9.30	0.82
900.0-999.9	5.06	13.51	0.60	13.23	0.70

(*) GWIN 1971 DATA

IF ONE EXCEPTS THE ENERGY RANGE 37.5-50 EV, THE CALCULATED ABSORPTION VALUES AGREE WELL WITH GWIN EXPERIMENTAL DATA; THEY ARE ON AVERAGE 1.2% LOWER IN THE ENERGY RANGE FROM 50 EV TO 1000 EV.

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COMMENTS ON THE 1 KEV TO 2 KEV ENERGY RANGE

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PRELIMINARY RESONANCE PARAMETERS WERE OBTAINED IN 1989 FROM THE ANALYSIS OF THE HARVEY THICK SAMPLE TRANSMISSION DATA AND OF THE PRELIMINARY RESULTS OF WESTON 88 FISSION MEASUREMENT. DUE TO LACK OF TIME, THE MEDIUM AND THIN SAMPLE TRANSMISSION DATA WERE NOT INCLUDED IN THE SAMMY DATA BASE, AND THE CONTRIBUTION OF THE TRUNCATED EXTERNAL RESONANCES WAS NOT CAREFULLY INVESTIGATED. NEVERTHELESS, THE RESULTS WERE USED IN THE ENDF/B-VI FILE, ALONG WITH A SMOOTH FILE IN ORDER TO AGREE WITH THE AVERAGE VALUES OF A PREVIOUS ENDF/B-VI EVALUATION (THIS PRELIMINARY SET OF PARAMETERS WAS CONSIDERED AS MORE USEFUL THAN THE STATISTICAL PARAMETERS IN THE ENERGY RANGE 1 KEV TO 2 KEV FOR THE CALCULATION OF THE SELF-SHIELDING FACTORS).

THE ANALYSIS WAS RESTARTED IN APRIL 1991 AT JAERI(TOKAI

RESEARCH ESTABLISHMENT) WITH AN UPDATED VERSION OF SAMMY ADAPTED BY T.NAKAGAWA TO THE FACOM 780. THE PRELIMINARY SET OF PARAMETERS OBTAINED AT OAK RIDGE IN 1989 WAS USED AS PRIOR INFORMATIONS TO START THE SAMMY CALCULATIONS. ALSO PRIOR TO THE ANALYSIS, THE CONTRIBUTION OF THE EXTERNAL RESONANCES WAS CALCULATED BY USING THE SET OF THE 0 KEV TO 1 KEV KNOWN RESONANCES, SHIFTED IN THE ENERGY RANGES -1 KEV TO 0 KEV, 2 KEV TO 3KEV AND 3 KEV TO 4 KEV; EQUIVALENT CONTRIBUTION WAS OBTAINED BY USING 3 FICTICIOUS RESONANCES BELOW 1 KEV AND 3 FICTICIOUS RESONANCES ABOVE 2 KEV(SEE DETAILS IN REF./13/). THE ANALYSIS WAS PERFORMED ON THE THICK AND MEDIUM SAMPLE TRANSMISSIONS OF HARVEY DATA (THE THIN SAMPLE DATA WAS NOT USEFUL IN THE HIGH ENERGY RANGE) AND ON THE 1988 FISSION DATA RELEASED BY WESTON AT THE BEGINNING OF 1991/7/. THE DEFINITIVE SAMMY FITS WERE PERFORMED IN APRIL 1992 AFTER RENORMALIZATION OF THE 1988 DATA OF WESTON ON THE ENDF/B-VI STANDARD VALUES BETWEEN 1 KEV AND 2 KEV, IN AGREEMENT WITH THE 1991 NEW MEASUREMENTS OF WESTON AND TODD.

THE AVERAGE CROSS SECTIONS CALCULATED FROM THE RESONANCE PARAMETERS ARE COMPARED TO THE EXPERIMENTAL VALUES IN THE FOLLOWING TABLE:

	CROSS-SECTIONS(BARN)					
	TOTAL		FISSION		CAPTURE	
ENERGY KEV	CALC(A)	EXP(B)	CALC(A)	EXP(C)	CALC(A)	EXP(D)
1.0-1.1	24.47	24.95	5.549	5.581	4.728	5.04
1.1-1.2	22.82	23.10	5.985	6.017	3.757	2.95
1.2-1.3	22.29	22.90	4.601	4.501	4.287	4.00
1.3-1.4	22.63	22.85	6.997	6.997	3.012	2.52
1.4-1.5	20.42	20.95	4.041	4.059	3.450	3.57
1.5-1.6	18.30	18.95	2.564	2.613	3.521	3.89
1.6-1.7	21.82	21.90	3.952	3.955	3.833	4.36
1.7-1.8	21.26	21.35	3.400	3.425	4.091	4.37
1.8-1.9	23.76	23.30	5.178	5.187	3.639	3.14
1.9-2.0	18.48	18.90	2.152	2.180	3.205	4.06
1.0-2.0	21.63	21.92	4.442	4.446	3.752	3.79

(A) TOTAL, FISSION AND CAPTURE CROSS SECTIONS CALCULATED BY RESENDD FROM THE RESONANCE PARAMETERS.
(B) EXPERIMENTAL TOTAL CROSS SECTIONS FROM REFERENCE/19/.
(C) WESTON AND TODD 1988 HIGH RESOLUTION FISSION CROSS SECTIONS FROM REFERENCE/7/ NORMALIZED TO ENDF/B-VI STANDARD IN THE ENERGY RANGE FROM 1.0 KEV TO 2.0 KEV.
(D) GWIN 1971 EXPERIMENTAL DATA NORMALIZED TO GWIN 1976 DATA.

THE DIFFERENCE OF 1.3% BETWEEN THE AVERAGE CALCULATED TOTAL CROSS SECTION AND THE AVERAGE EXPERIMENTAL CROSS SECTION IN THE ENERGY RANGE FROM 1.0 KEV AND 2.0 KEV IS MAINLY DUE TO THE METHOD OF EVALUATING THE TOTAL CROSS SECTION FROM THE EFFECTIVE CROSS SECTION IN REFERENCE/19/. THE ACCURACY OF THE SAMMY FIT OF THE EXPERIMENTAL TRANSMISSION DATA IS BETTER THAN 0.5% ON THE CROSS SECTION. THE CALCULATED FISSION CROSS SECTIONS ARE IN VERY GOOD AGREEMENT WITH THE EXPERIMENTAL DATA. THE CAPTURE DATA /1/ ARE AVERAGE VALUES OBTAINED FROM THE DATA AVAILABLE IN THE EXFOR FILE AND NORMALIZED TO GWIN 1976 AVERAGE VALUES; THERE ARE LARGE DIFFERENCES BETWEEN THE CALCULATED DATA AND THE EXPERIMENTAL DATA AVERAGED OVER 0.1 KEV INTERVALS; BUT ON THE INTERVAL FROM 1.0 KEV TO 2.0 KEV THE AVERAGE VALUES ARE CONSISTENT WITHIN 1.0%.

COMMENTS ON THE 2.0 KEV TO 2.5 KEV REGION

THIS ENERGY RANGE WAS ALSO ANALYSED AT JAERI /13/. NO PRELIMINARY SET OF RESONANCE PARAMETERS WAS AVAILABLE PRIOR TO THE ANALYSIS. MORE THAN 90% OF THE RESONANCES, COMPARED TO THE LOW ENERGY RANGE, COULD STILL BE IDENTIFIED IN THE TRANSMISSION DATA BETWEEN 2 KEV AND 2.5 KEV. THEREFORE THE CORRELATED SAMMY ANALYSIS OF HARVEY TRANSMISSIONS AND WESTON FISSION WAS STILL FEASIBLE IN THIS ENERGY RANGE. THE RESONANCE PARAMETERS OBTAINED ARE CONSISTENT AND HAS NEARLY THE SAME STATISTICAL PROPERTIES AS THOSE OF THE RESONANCES IN THE 0 TO 2 KEV ENERGY RANGE. A QUITE GOOD FIT OF THE TRANSMISSION AND FISSION DATA WAS OBTAINED WITHOUT BACKGROUND AND NORMALISATION ADJUSTMENT. HOWEVER, THE CALCULATED FISSION CROSS SECTIONS ARE, ON AVERAGE, 1.4% LOWER THAN THE EXPERIMENTAL VALUES. THIS DIFFERENCE,WHICH HOWEVER IS NOT LARGER

THAN THE SYSTEMATIC ERRORS ON THE EXPERIMENTAL DATA, COULD BE DUE TO THE DIFFICULTIES OF IDENTIFYING THE WIDE J=0+ RESONANCES IN THE EXPERIMENTAL DATA, BECAUSE THE EFFECTS OF THE INCREASING RESOLUTION AND DOPPLER WIDTHS. PRIOR TO THE SAMMY FITS, THE FISSION DATA OF WESTON AND TODD (1988 HIGH RESOLUTION DATA) WERE NORMALIZED TO THE ENDF/B-VI STANDARD IN THE ENERGY RANGE FROM 1 KEV TO 2 KEV.

THE CROSS SECTIONS,CALCULATED FROM THE RESONANCE PARAMETERS AND AVERAGED OVER 0.1 KEV INTERVALS,ARE GIVEN IN THE FOLLOWING TABLE:

ENERGY (KEV)	TOTAL CALC(A)	TOTAL EXP(B)	FISSION CALC(A)	FISSION EXP(C)	CAPTURE CALC(A)
2.0-2.1	17.34	17.30	2.034	2.062	3.223
2.1-2.2	20.27	19.80	2.949	2.999	4.051
2.2-2.3	19.34	19.10	2.357	2.393	3.324
2.3-2.4	21.28	21.20	3.646	3.679	3.640
2.4-2.5	20.03	20.60	3.956	4.024	3.128
2.0-2.5	19.65	19.60	2.989	3.031	3.473

CROSS-SECTIONS(BARN)

(A) TOTAL, FISSION AND CAPTURE CROSS SECTIONS CALCULATED BY RESENDD, 1% ACCURACY, AT 300 K,FROM THE RESONANCE PARAMETERS.

(B) AVERAGE TOTAL CROSS SECTIONS OBTAINED FROM THE AVERAGE EXPERIMENTAL EFFECTIVE CROSS SECTIONS IN REFERENCE/19/.

(C) 1988 HIGH RESOLUTION DATA OF WESTON AND TODD NORMALIZED TO ENDF/B-VI STANDARD IN THE ENERGY RANGE FROM 1 KEV TO 2 KEV.

FISSION AND CAPTURE RESONANCE INTEGRALS

THE FISSION AND CAPTURE RESONANCE INTEGRALS ARE COMPARED TO JENDL-3 DATA IN THE FOLLOWING TABLE:

ENERGY RANGE(EV)	FISSION(BARN) JENDL-3	FISSION(BARN) PRESENT	CAPTURE(BARN) JENDL-3	CAPTURE(BARN) PRESENT
0.5 - 5.0	85.725	84.879	28.651	28.723
5.0 - 10.0	25.081	25.147	19.059	18.950
10.0 - 50.0	96.856	99.715	77.181	74.686
50.0 - 100.0	40.479	41.552	25.930	25.376
100.0 - 301.0	19.677	20.252	17.952	17.729
301.0 -1000.0	10.047	10.317	8.348	8.418
1000.0 -2000.0	3.484	3.206	2.840	2.634
2000.0 -2.E+07	17.783	(17.783)	5.224	(5.224)
TOTAL	299.132	302.851	185.185	181.739

THE JENDL-3 RESONANCE PARAMETERS ARE THOSE OBTAINED IN 1987 IN THE ENERGY RANGE 0 KEV TO 1 KEV. THEY ARE SLIGTHLY DIFFERENT FROM THOSE PUBLISHED IN 1989. THAT EXPLAINS THE SMALL DIFFERENCES OBSERVED BETWEEN JENDL-3 AND THE PRESENT RESULTS IN THIS ENERGY RANGE. IN THE ENERGY RANGE 1 KEV TO 2 KEV JENDL-3 IS UNRESOLVED RANGE. THE FISSION AND CAPTURE RESONANCE INTEGRALS CALCULATED FROM ENDF/B-V AND THOSE FOUND IN BNL-325 ARE THE FOLLOWING:

ENDF/B-V	FISSION: 302.13 B	CAPTURE: 194.10 B
BNL-325	FISSION: 310+-10 B	CAPTURE: 200+-20 B

THE CONSEQUENCE OF CHANGING FROM THE OLD SETS OF RESONANCE PARAMETERS(ENDF/B-V AND PREVIOUS SETS) TO THE NEW SET IS THAT THE CAPTURE RESONANCE INTEGRAL WILL DECREASE BY 6.7% COMPARED WITH ENDF/B-V VALUE.

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MAT number = 9440

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 94-PU-240 NAIG+      EVAL-MAY87 T.MURATA, A.ZUKERAN
                      DIST-SEP89 REV2-AUG93
HISTORY
87-05 EVALUATION WAS MADE BY
        T.MURATA (NAIG)    : CROSS SECTIONS ABOVE RESONANCE REGION
                   AND OTHER QUANTITIES,
        A.ZUKERAN(HITACHI): RESONANCE PARAMETERS.
88-06 MT'S=16, 17, 37 AND 102 WERE MODIFIED.
89-02 FP YIELDS WERE TAKEN FROM JNDC FP DECAY FILE VERSION-2.
        COMPILATION WAS MADE BY T. NAKAGAWA (JAERI).
90-07 FP YIELD DATA WERE MODIFIED.
90-10 MF=5, MT=16, 17, 91: MODIFIED AT THRESHOLD ENERGIES.
93-08 JENDL-3.2.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (1,452), (1,455)
     ***********************************************************


MF=1  GENERAL INFORMATION
  MT=451  COMMENTS AND DICTIONARY
  MT=452  NUMBER OF NEUTRONS PER FISSION
      SUM OF MT=455(DELAYED NEUTRONS) AND MT=456(PROMPT NEUTRONS).
  MT=455  DELAYED NEUTRON DATA
      BELOW 5 MEV, NU-D OF 0.00911 MEASURED BY BENEDETTI ET AL.
      /1/ WAS ADOPTED.  ABOVE 6 MEV, 0.0067 WAS GIVEN ON THE BASIS
      OF TUTTLE'S SYSTEMATICS /2/.  DECAY CONSTANTS WERE TAKEN
      FROM EVALUATION BY BARDY AND ENGLAND /3/.
  MT=456  NUMBER OF PROMPT NEUTRONS
      LINEAR LEAST-SQUARES FITTING TO THE EXPERIMENTAL DATA OF
      FREHAUT ET AL. /4/ RENORMALIZED TO CF-252 NU-P=3.756.

MF=2  RESONANCE PARAMETERS
  MT=151  RESOLVED AND UNRESOLVED RESONANCE PARAMETERS
  1) RESOLVED RESONANCES FOR MLBW FORMULA (1.0E-5 TO 4 KEV)
      PARAMETERS OF A NEGATIVE AND THE 1.057-EV RESONANCES WERE
      REVISED ON THE BASIS OF RECOMMENDATION BY MUGHABGHAB /5/.
      NEUTRON AND CAPTURE WIDTHS OF OTHER LEVELS WERE BASED ON THE
      EXPERIMENTAL DATA BY HOCKENBURY ET AL. /6/ IN THE ENERGY
      RANGE FROM 20 TO 500 EV, AND KOLAR AND BOECKHOFF /7/ FROM
      500 EV TO 4 KEV.  THE AVERAGE CAPTURE WIDTH OF 29.5 MILLI-EV
      WAS ASSUMED FOR THE RESONANCES WHOSE CAPTURE WIDTHS WERE
      UNKNOWN.  BELOW 610 EV, THE SUB-THRESHOLD FISSION WIDTHS
      WERE CALCULATED FROM THE AREA DATA BY WESTON AND TODD /8/.
      ABOVE 610 EV, THEY WERE TAKEN FROM THE DATA BY AUCHAMPAUGH
      AND WESTON /9/.
  2) UNRESOLVED RESONANCES (4 TO 40 KEV)
      ENERGY DEPENDENT PARAMETERS WERE DETERMINED TO REPRODUCE THE
      EVALUATED CROSS SECTIONS IN THIS ENERGY REGION.  FISSION
      WIDTHS WERE ADJUSTED TO AVERAGE CROSS SECTIONS MEASURED BY
      WESTON AND TODD /8/.

      CALCULATED 2200-M/SEC CROSS SECTIONS AND RES. INTEGERALS.
                     2200-M/SEC      RES. INTEG.
          TOTAL      291.13   B
          ELASTIC      1.644  B            -
          FISSION      0.0588 B          8.94 B
          CAPTURE    289.4    B      8110.    B

MF=3  NEUTRON CROSS SECTIONS
  BELOW 4 KEV: BACKGROUND CROSS SECTIONS ARE GIVEN TO THE CAPTURE
               CROSS SECTION.
  ABOVE 4 KEV: EVALUATED AS FOLLOWS.  IN THE ENERGY RANGE FROM 4
               TO 40 KEV, THE CROSS SECTIONS ARE REPRESENTED WITH
               THE UNRESOLVED RESONANCE PARAMETERS, AND THE BACK-
               GROUND CROSS SECTIONS ARE GIVEN IN MF=3.
  MT=1    TOTAL
      EVALUATED WITH SPLINE FITTING TO THE EXPERIMENTAL DATA OF
      SMITH ET AL./10/, KAEPPELER ET AL./11/ AND POENITZ ET
      AL./12/

  MT=2    ELASTIC SCATTERING
      OBTAINED BY SUBTRACTING THE OTHER CROSS SECTIONS FROM TOTAL
      CROSS SECTION.

  MT=4    TOTAL INELASTIC SCATTERING
      SUM OF PARTIAL INELASTIC SCATTERING CROSS SECTIONS (MT=51
      TO MT=91).

  MT=51-78, 91  PARTIAL INELASTIC SCATTERING
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      BELOW 3 MEV, THE RESULTS OF STATISTICAL AND COUPLED-CHANNEL
      CALCULATION MADE BY LAGRANGE ET AL. /13/ WERE ADOPTED.  FOR
      SOME LEVELS, FOR WHICH SMITH'S EXPERIMENTAL DATA /14/ WERE
      AVAILABLE, THE CALCULATED RESULTS WERE NORMALIZED (FOR 1ST,
      2ND, 3RD, 5TH AND 9 TO 11TH LEVELS).

      LEVEL SCHEME
           NO.      ENERGY(MEV)   SPIN-PARITY
           G.S.       0.0            0 +
            1         0.04285        2 +
            2         0.14169        4 +
            3         0.29431        6 +
            4         0.4976         8 +
            5         0.59736        1 -
            6         0.64889        3 -
            7         0.74232        5 -
            8         0.8607         0 +
            9         0.90032        2 +
           10         0.93807        1 -
           11         0.95887        2 -
           12         0.9924         4 +
           13         1.0018         3 -
           14         1.0306         3 +
           15         1.0375         4 -
           16         1.0764         4 +
           17         1.0895         0 +
           18         1.1155         5 -
           19         1.1370         2 +
           20         1.1615         6 -
           21         1.1778         3 +
           22         1.2230         2 +
           23         1.2325         4 +
           24         1.2408         2 -
           25         1.2621         3 +
           26         1.2820         3 -
           27         1.30873        5 -
           28         1.41079        0 +
         LEVELS ABOVE 1.4108 MEV WERE ASSUMED TO BE CONTINUUUM.

  MT=16,17,37  (N,2N),(N,3N) AND (N,4N)
      CALCULATED FROM NEUTRON EMISSION CROSS SECTION AND BRANCHING
      RATIO TO EACH REACTION CHANNEL.  NEUTRON EMISSION CROSS
      SECTION WAS OBTAINED BY SUBTRACTING THE FISSION AND CAPTURE
      CROSS SECTIONS FROM COMPOUND NUCLEUS FORMATION CROSS SECTION
      CALCULATED WITH SPHERICAL OPTICAL MODEL.  BRANCHING RATIO
      WAS OBTAINED FROM FORMALISM GIVEN BY SEGEV ET AL. /15/

  MT=18   FISSION
    BELOW 100 KEV: AVERAGE VALUES OF FISSION CROSS SECTION
      MEASURED BY WESTON AND TODD /8/ WERE NORMALIZED TO THE
      VALUE AT 100 KEV OF THE SIMULTANEOUS EVALUATION.
    ABOVE 100 KEV: SIMULTANEOUS EVALUATION WAS MADE BY TAKING
      ACCOUNT OF EXPERIMENTAL DATA OF FISSION RATIO AND ABSOLUTE
      CROSS SECTIONS OF U-235, U-238, PU-239, PU-240 AND PU-241,
      AND CAPTURE CROSS SECTION OF AU-197 /16/.

  MT=102  CAPTURE
    BELOW 350 KEV: BASED ON THE EXPERIMENTAL DATA OF HOCKENBURY ET
      AL. /6/, WESTON AND TODD /17/ AND THE RATIO DATA OF WISSHAK
      AND KAEPPELER /18/ WITH THE CAPTURE CROSS SECTION OF AU-197
      /16/.  AS A GUIDE LINE, STATISTICAL MODEL CALCULATION WAS
      MADE WITH CASTHY CODE /19/.
    ABOVE 350 KEV: THE STATISTICAL MODEL CALCULATION WAS
      NORMALIZED TO THE VALUE AT 350 KEV.  DIRECT AND COLLECTIVE
      CAPTURE WAS INCLUDED IN HIGH ENERGY REGION ADOPTING THE
      VALUE FOR U-238 GIVEN BY KITAZAWA ET AL. /20/.

      THE SPHERICAL OPTICAL POTENTIAL PARAMETERS
         V   = 40.6 - 0.05*EN,  WS = 6.5 + 0.15*EN (MEV)
         VSO= 7.0                                  (MEV)
         R   = RSO =1.32      ,  RS = 1.38         (FM)
         A   = AS  = ASO =0.47                     (FM)
      LEVEL DENSITY PARAMETERS WERE DETERMINED TO REPRODUCE THE
      RESONANCE LEVEL SPACINGS AND STAIRCASES OF DISCRETE LEVELS.

  MT=251  MU-BAR
      THE SAME AS JENDL-1 /21/ EXCEPT FOR 20 MEV.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2
      TAKEN FROM JENDL-1 /21/.
  MT=16,17,18,37,91
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      ASSUMED TO BE ISOTROPIC IN THE LABORATORY SYSTEM.
  MT=51-78
      FOR THE 1ST AND 2ND LEVELS, RESULTS OF LAGRANGE ET AL. /13/
      WERE ADOPTED.  FOR OTHERS, STATISTICAL AND DWBA CALCULATIONS
      WERE MADE.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,91
      CALCULATED WITH  PRE-COMPOUND AND MULTI-STEP EVAPORATION
      THEORY CODE PEGASUS /22/.
  MT=37
      EVAPORATION SPECTRUM WAS GIVEN.
  MT=18  FISSION SPECTRA
      CALCULATED FROM MADLAND-NIX FORMULA /23/.
         AVERAGE ENERGY RELEASE                  = 199.179 MEV
         TOTAL AVERAGE FF KINETIC ENERGY         = 177.53 MEV
         AVERAGE MASS NUMBER OF LIGHT FF         = 101
         AVERAGE MASS NUMBER OF HEAVY FF         = 140
         LEVEL DENSITY PARAMETER                 = A/10.0
  MT=455  DELAYED NEUTRON SPECTRA
      ASSUMED TO BE THE SAME AS PU-239 WHICH WERE TAKEN FROM THE
      EVALUATION BY SAPHIER ET AL. /24/.

MF=8  FISSION PRODUCT YIELDS
  MT=454  INDEPENDENT YIELDS
  MT=459  CUMULATIVE YIELDS
      BOTH WERE TAKEN FROM JNDC FP DECAY FILE VERSION-2/25/.

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MAT number = 9443
 94-PU-241 JAERI      EVAL-OCT87 Y.KIKUCHI,N.SEKINE,T.NAKAGAWA
                      DIST-SEP89 REV2-MAY93
HISTORY
79-10 NEW EVALUATION WAS MADE BY Y.KIKUCHI (JAERI) AND N.SEKINE
      (HEC) /1/.  DATA OF JENDL-1 /2/ WERE SUPERSEDED.
79-12 FILES 2, 3 AND 4 WERE RELEASED AS JENDL-2B /3/.
87-03 THE FISSION CROSS SECTION WAS REVISED BY ADOPTING RESULTS OF
      SIMULTANEOUS EVALUATION /4/ FOR JENDL-3.
89-02 FP YIELDS WERE ADDED.
90-07 FP YIELD DATA WERE MODIFIED.
93-05 JENDL-3.2.
      RESOLVED RESONANCE PARAMETERS EVALUATED BY DERRIEN AND
      DE SAUSSURE/5/ (ADOPTED IN ENDF/B-VI) WERE MODIFIED BY
      H.DERRIEN (JAERI)/6/.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (2,151)       RESOLVED RESONANCE PARAMETERS UP TO 300 EV
     ***********************************************************


MF=1  GENERAL INFORMATION
  MT=451   COMMENT AND DICTIONARY
  MT=452   NUMBER OF NEUTRONS PER FISSION
      SUM OF NU-P (MT=456) AND NU-D (MT=455).
  MT=455   DELAYED NEUTRON DATA
      DATA OF BENEDETTI+ /7/
  MT=456   NUMBER OF PROMPT NEUTRONS PER FISSION
      DATA OF BOLDEMAN AND FREHAUT /8/ FOR THERMAL FISSION WERE
      ADOPTED AT LOW ENERGIES BY ASSUMING NU-P(CF-252 SPONTANEOUS
      FISSION) = 3.753 FOR JENDL-2.  FOR JENDL-3, DATA WERE
      INCREASED BY A FACTOR OF 3.756/3.753.  AN ENERGY DEPENDENT
      TERM WAS BASED ON FREHAUT+ /9/

MF=2,MT=151   RESONANCE PARAMETERS
  RESOLVED RESONANCES : 1 - 300 EV  (REICH-MOORE FORMULA)
      PARAMETERS WERE EVALUATED BY DERRIEN AND DE SAUSSURE/5/,
      AND MODIFIED BY DERRIEN /6/.  DETAILS OF THE MODIFICATION
      ARE GIVEN IN APPENDIX.

  UNRESOLVED RESONANCES : 300 EV - 30 KEV
      OBTAINED BY FITTING EVALUATED FISSION AND CAPTURE CROSS
      SECTIONS.
         ENERGY DEPENDENT PARAMETERS : S0, S1 AND GAM-F.
         FIXED PARAMETERS : R=9.8 FM , GAM-G = 0.040 EV,
                                   D-OBS = 0.85 EV

  2200-M/SEC CROSS SECTIONS AND CALCULATED RESONANCE INTEGRALS.
                     2200 M/SEC      RES. INTEG.
        TOTAL        1384.9  B          -
        ELASTIC        11.35 B          -
        FISSION      1012.0  B        572.6 B
        CAPTURE       361.53 B        179.9 B

MF=3  NEUTRON CROSS SECTIONS
  ABOVE 300 EV, SMOOTH CROSS SECTIONS WERE GIVEN AS FOLLOWS.
  BETWEEN 300 EV AND 30 KEV, CROSS SECTIONS WERE REPRESENTED WITH
  THE UNRESOLVED RESONANCE PARAMETES.

  MT=1, 2, 4, 51-61, 91, 251 : TOTAL, ELASTIC, INELASTIC
   SCATTERING CROSS SECTIONS AND MU-BAR
     CALCULATED WITH OPTICAL AND STATISTICAL MODELS.  OPTICAL
     POTENTIAL PARAMETERS USED WERE OBTAINED FROM SYSTEMATICS/10/
           V = 40.25 - 0.05*EN , WS = 6.5  , VSO = 7.0   (MEV)
           R = RSO = 1.32      , RS = 1.38               (FM)
           A = B = ASO = 0.47                            (FM)
     STATISTICAL MODEL CALCULATION WAS PERFORMED WITH CASTHY CODE
     /11/.  COMPETING PROCESSES (FISSION, (N,2N), (N,3N), (N,4N))
     AND LEVEL FLUCTUATION WERE TAKEN INTO THE CALCULATION.  THE
     LEVEL SCHEME TAKEN FROM REF./12/.
                  NO          ENERGY(KEV)   SPIN-PARITY
                 G.S.             0            5/2 +
                   1             41.8          7/2 +
                   2             94.0          9/2 +
                   3            161.5          1/2 +
                   4            170.8          3/2 +
                   5            223.1          5/2 +
                   6            230.0          9/2 +
                   7            242.7          7/2 +
                   8            300           11/2 +
                   9            335            9/2 +
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10	368	13/2 +
11	445	11/2 -

CONTINUUM LEVELS ASSUMED ABOVE 490 KEV.
THE LEVEL DENSITY PARAMETERS: GILBERT AND CAMERON /13/.

MT=16, 17, 37 (N,2N), (N,3N), (N,4N)
CALCULATED WITH EVAPORATION MODEL.

MT=18 FISSION
ABOVE 70 KEV, SIMULTANEOUS EVALUATION WITH U-235, U-238, PU-240, PU-241 /4/ WERE ADOPTED. THE EXPERIMENTAL DATA TAKEN INTO ACCOUNT ARE THOSE BY SZABO+ /14,15/, CARLSON+ /16,17/, FURSOV+ /18/AND KEAPPELER+ /19/. BELOW 45 KEV, JENDL-2 WAS ADOPTED. THESE TWO SETS OF DATA WERE CONNECTED SMOOTHLY BETWEEN 45 AND 70 KEV.

MT=102 CAPTURE
BASED ON THE DATA OF ALPHA BY WESTON+ /20/ UP TO 250 KEV. CALCULATED WITH CASTHY ABOVE 250 KEV. THE GAMMA-RAY STRENGTH FUNCTION WAS DETERMINED SO THAT THE CAPTURE CROSS SECTION WAS 269 MB AT 250 KEV.

MF=4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=2, 51-61 : CALCULATED WITH CASTHY.
MT=16,17,18,37,91 : ISOTROPIC IN THE LABORATORY SYSTEM.

MF=5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=16,17,18,37,91
CALCULATED WITH PRE-EQUILIBRIUM AND MULTI-STEP EVAPORATION CODE PEGASUS/21/.
MT=18 PROMPT FISSION NEUTRON SPECTRUM.
DETERMINED FROM Z**2/A SYSTEMATICS BY SMITH ET AL. /22/.
MT=455 DELAYED NEUTRON SPECTRUM.
EVALUATION BY SAPHIER ET AL. /23/ WAS ADOPTED.

MF=8 FISSION PRODUCT YIELDS
MT=454 INDEPENDENT YIELDS
MT=459 CUMULATIVE YIELDS
BOTH WERE TAKEN FROM JNDC FP DECAY FILE VERSION-2/24/.

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APPENDIX REVISED RESONANCE DATA ,JAERI MAY 1993
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REVISION OF THE 241PU REICH-MOORE RESONANCE PARAMETERS
BY COMPARISON WITH RECENT FISSION CROSS SECTION MEASUREMENTS.

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I-INTRODUCTION.

THE RESONANCE PARAMETERS OF THE NEUTRON CROSS SECTIONS OF 241PU WERE OBTAINED BY DERRIEN AND DE SAUSSURE/1/ IN THE ENERGY RANGE FROM THERMAL TO 300 EV BY A BAYESIAN FIT OF SELECTED EXPERIMENTAL EFFECTIVE TOTAL CROSS SECTIONS, FISSION AND CAPTURE CROSS SECTIONS BY USING THE REICH-MOORE FITTING CODE SAMMY/2/. THE RESULTS OF THIS WORK WERE USED IN THE ENDF/B-VI EVALUATED DATA FILE. SOME DIFFICULTIES WERE ENCOUNTERED IN THE NORMALIZATION OF THE EXPERIMENTAL FISSION CROSS SECTIONS DUE TO THE DISCREPANCIES IN THE SHAPE OF THE AVAILABLE EXPERIMENTAL DATA BOTH IN THERMAL AND HIGH ENERGY RANGES. THE CONSISTENCY AMONG THE EXPERIMENTAL DATA BASE COULD NOT BE OBTAINED WITHOUT LARGE RENORMALIZATION AND BACKGROUND CORRECTION PARAMETERS IN THE SAMMY FITS. PARTICULARLY, IT WAS SHOWN THAT THE DISCREPANCY BETWEEN THE FISSION CROSS SECTIONS IN THE THERMAL ENERGY RANGE WAS DUE TO A DEVIATION FROM THE 1/V SHAPE BELOW ABOUT 0.05 EV.

NEW FISSION CROSS SECTION MEASUREMENTS WERE RECENTLY PERFORMED BY WAGEMANS ET AL./3,4/ IN THE ENERGY RANGE FROM 0.002 EV TO 20 EV IN ORDER TO CHECK THE SHAPE OF THE CROSS SECTION IN THE THERMAL ENERGY RANGE. THEY SHOWED THAT THE SHAPE OF THE FISSION CROSS SECTION WAS CLEARLY COMPATIBLE WITH THE 1/V LAW, IN CONTRADICTION TO ALL THE PREVIOUS MEASUREMENTS REPORTED IN THE LITTERATURE. CONSEQUENTLY, THE NORMALIZATION OF ALL THE PREVIOUS RESULTS USING THE LOW ENERGY REGION COULD BE ERRONEOUS. PARTICULARLY, THE DISCREPANCY OBSERVED IN THE AVERAGE FISSION CROSS SECTION OVER THE 0.26 EV RESONANCE COULD BE DUE TO THE ERRORS OF NORMALIZATION IN THE THERMAL REGION. WAGEMANS ET AL. COMPARED THE ENDF/B-VI DATA TO THEIR NEW RESULTS AND CONCLUDED THAT THE EVALUATED DATA FILES USING THE EVALUATION OF DERRIEN AND DE SAUSSURE SHOULD BE REVISED IN THE ENERGY RANGE UP TO 300 EV.

II-COMMENTS ON ENDF/B-VI EVALUATION.

IN THE ENERGY RANGE FROM 0.01 EV TO 3 EV THE NEW DATA OF WAGEMANS ET AL. ARE ON AVERAGE 2.2 % SMALLER THAN ENDF/B-VI. THIS DIFFERENCE IS MAINLY DUE A DIFFERENCE OF 3% BETWEEN THE 1976 DATA OF WAGEMANS ET AL./5/ AND THE NEW VALUES OF WAGEMANS ET AL. THE 1976 DATA OF WAGEMANS ET AL. WERE USED IN THE EVALUATION OF DERRIEN AND DE SAUSSURE IN THE LOW ENERGY REGION.

IN THE INTERMEDIATE ENERGY RANGE FROM 3 EV TO 12 EV, THE AVERAGE FISSION OF ENDF/B-VI IS IN EXCELLENT AGREEMENT WITH THE NEW DATA OF WAGEMANS ET AL. IN THIS ENERGY RANGE, THE SAMMY FITS OF DERRIEN AND DE SAUSSURE WERE PERFORMED ON THE FISSION CROSS SECTION OF WESTON AND TODD/6/, OF BLONS/7/ AND OF MIGNECO ET AL./8/ WITH AN ADJUSTMENT OF THE NORMALIZATION FACTOR AND OF THE BACKGROUND CORRECTION PARAMETERS OF ALL THE EXPERIMENTAL DATA; THE AGREEMENT BETWEEN THE NEW DATA OF WAGEMANS ET AL. AND ENDF/B-VI SHOWS THAT, AT LEAST IN THIS ENERGY RANGE, SAMMY PERFORMED ON THE DATA OF WESTON AND TODD A RENORMALIZATION EQUIVALENT TO THAT RECOMMENDED BY WAGEMANS ET AL./4/.

IN THE HIGHER RANGE UP TO 300 EV, THE SAMMY FITS RELIED MAINLY ON THE HIGH RESOLUTION MEASUREMENTS OF BLONS AND OF MIGNECO ET AL. FOR THE ACCURATE DETERMINATION OF THE RESONANCE PARAMETERS. QUITE LARGE NORMALIZATION COEFFICIENTS AND BACKGROUND CORRECTION PARAMETERS WERE ALSO NEEDED IN THIS ENERGY RANGE TO OBTAIN THE CONSISTENCY BETWEEN THE CALCULATED CROSS SECTIONS AND THE EXPERIMENTAL DATA. HOWEVER, THE RESULT OF THE FITS WAS IN QUITE GOOD AGREEMENT WITH THE DATA OF WESTON AND TODD NORMALIZED TO THE 1976 DATA OF WAGEMANS ET AL. IN THE LOW ENERGY REGION,WHICH IS ALSO EQUIVALENT TO THE NORMALIZATION TO THE 1983 DATA OF WAGEMANS ET AL./9/. SINCE THE EARLIER DATA OF WAGEMANS ET AL. SHOULD DECREASE BY 3% TO BE CONSISTENT WITH THE NEW DATA, IT IS LIKELY THAT THE ENDF/B-VI FISSION CROSS SECTION COULD BE TOO LARGE BY ABOUT 3% IN THE ENERGY RANGE ABOVE 12 EV.

III-REVISION OF THE RESONANCE PARAMETERS.

AN ACCURATE UP-DATING OF THE 241PU RESONANCE PARAMETERS COULD BE OBTAINED BY RENORMALIZING THE FISSION EXPERIMENTAL DATA BASE ACCORDING TO THE NEW DATA OF WAGEMANS ET AL. AND BY RESTARTING THE SAMMY FITS OF THE NEW EXPERIMENTAL DATA BASE, INCLUDING THE HIGH RESOLUTION TRANSMISSION DATA OF HARVEY AND SIMPSON/10/. DUE TO LACK OF TIME A NEW SAMMY ANALYSIS WAS PERFORMED ONLY IN THE ENERGY RANGE FROM 0.002 EV TO 3 EV. IN THE ENERGY RANGE ABOVE 3 EV THE UP-DATING WAS PERFORMED BY APPLYING SOME SMALL CORRECTIONS TO THE RESONANCE PARAMETERS.

THE SAMMY ANALYSIS OF THE NEW WAGEMANS ET AL. DATA WAS PERFORMED ALONG WITH THE TOTAL CROSS SECTION OF YOUNG AND SMITH/11/ IN THE ENERGY RANGE FROM 0.002 EV TO 3 EV, BY STARTING WITH THE ENDF/B-VI RESONANCE PARAMETERS. ONLY THE PARAMETERS OF THE 3+ RESONANCES AT -0.122 EV AND AT 0.265 EV WERE ADJUSTED IN

THIS ENERGY RANGE. THE VALUES OF THE CROSS SECTIONS CALCULATED AT 0.0253 EV ARE COMPARED TO THE STANDARD DATA/12/ IN TABLE 1. THE AVERAGE TOTAL, FISSION AND CAPTURE CROSS SECTIONS CALCULATED WITH THE NEW RESONANCE PARAMETERS ARE DISPLAYED ON TABLES 2, 3 AND 4 WITH THE CORRESPONDING EXPERIMENTAL DATA AND THE VALUES OBTAINED FROM ENDF/B-VI. ONE SHOULD POINT OUT THAT AN ENERGY SHIFT OF DE/E=+0.00384 WAS APPLIED TO THE DATA OF YOUNG AND SMITH IN ORDER TO ACHIEVE A GOOD CONSISTENCY WITH THE ENERGY SCALE OF THE FISSION DATA OF WAGEMANS ET AL. OVER THE RESONANCE AT 0.0265 EV.

IN THE ENERGY RANGE ABOVE 3 EV THE SMALL CORRECTIONS APPLIED TO THE RESONANCE PARAMETERS RESULT IN A DECREASE OF THE AVERAGE FISSION CROSS SECTION AND IN AN INCREASE OF THE AVERAGE CAPTURE CROSS SECTION, WITH A VARIATION OF THE AVERAGE TOTAL CROSS SECTION SMALLER THAN THE ERRORS OF THE EXPERIMENTAL DATA OF HARVEY AND SIMPSON. THE AVERAGE VALUES OF THE FISSION AND CAPTURE CROSS SECTIONS CALCULATED WITH THE NEW RESONANCE PARAMETERS ARE SHOWN IN TABLE 5 AND 6 ALONG WITH THE RENORMALIZED FISSION CROSS SECTION OF WESTON AND TODD AND THE VALUES CALCULATED FROM ENDF/B-VI.

IV-CONCLUSION.

THE RESULTS OF THE RECENT MEASUREMENT OF THE 241PU FISSION CROSS SECTION IN THE ENERGY RANGE FROM 0.002 EV TO 4 EV OF WAGEMANS ET AL. WERE USED IN A NEW EVALUATION OF THE RESONANCE PARAMETERS. THE ACCURACY OF THE CALCULATED CROSS SECTIONS WAS GREATLY IMPROVED IN THE RESONANCE AT 0.265 EV. THE CROSS SECTIONS AVERAGED OVER THIS RESONANCE SHOULD HAVE THE SAME ACCURACY THAN THE STANDARD VALUES AT 0.0253 EV. IN THE HIGH ENERGY REGION UP TO 300 EV THE SAMMY ANALYSIS OF THE NEW EXPERIMENTAL DATA BASE OBTAINED BY THE RENORMALIZATION OF THE EXPERIMENTAL DATA IS RECOMMENDED IN ORDER TO IMPROVE THE CORRECTIONS TO THE RESONANCE PARAMETERS PERFORMED IN THE PRESENT WORK.

TABLE 1 CROSS SECTIONS AT 0.0253 EV

	PRESENT RESULTS	ENDF/B-VI STANDARD/12/
FISSION	1012.50(-0.0%)	1012.68+-6.58
CAPTURE	361.52(+0.1%)	361.29+-4.95
SCATTERING	11.36(-7.1%)	12.17+-2.62
TOTAL	1385.38(-0.1%)	1386.14+-8.64

TABLE 2 THE TOTAL CROSS SECTION INTEGRAL IN THE ENERGY RANGE FROM 0.0021 EV TO 3 EV.

ENERGY RANGE (EV)	PRESENT WORK (B*EV)	ENDF/B-VI (B*EV)	YOUNG AND SMITH/11/ (B*EV)
0.0021-0.020	43.54	43.09(-1.0%)	43.25(-0.7%)
0.0200-0.030	14.03	14.02(-0.1%)	14.01(-0.1%)
0.0300-0.100	65.09	66.17(+1.7%)	64.99(-0.1%)
0.1000-0.500	378.38	385.27(+1.8%)	380.10(+0.4%)
0.5000-1.000	29.74	29.41(-1.1%)	31.19(+4.4%)
1.0000-3.000	83.36	83.92(+0.7%)	82.50(-1.0%)
0.0021-3.000	614.14	621.88(+1.3%)	616.04(+0.3%)

TABLE 3 THE FISSION CROSS SECTION INTEGRAL IN THE ENERGY RANGE FROM 0.0021 EV TO 3 EV.

ENERGY RANGE (EV)	THIS WORK (B*EV)	ENDF/B-VI (B*EV)	WAGEMANS ET AL. (B*EV)/4/	WESTON AND TODD (B*EV)/6/
0.0021-0.020	31.06	30.61(-1.5%)	31.09(+0.1%)	
0.0200-0.030	10.24	10.22(-0.2%)	10.24(0.0%)	
0.0300-0.100	49.02	50.02(+2.0%)	48.70(-0.6%)	
0.1000-0.500	262.76	270.84(+3.1%)	264.58(+0.7%)	262.53(-0.1%)
0.5000-1.000	17.93	17.64(-1.6%)	17.60(-1.8%)	17.67(-1.4%)
1.0000-3.000	54.88	55.62(+1.3%)	54.40(-0.9%)	55.06(+0.3%)
0.0021-3.000	425.89	434.95(+2.1%)	426.61(+0.2%)	
0.1000-3.000	335.57	344.10(+2.5%)	336.58(+0.3%)	335.26(-0.1%)

WESTON AND TODD EXPERIMENTAL DATA WERE NORMALIZED TO WAGEMANS ET AL./4/ IN THE ENERGY RANGE FROM 0.1 EV TO 12 EV (ORIGINAL EXFOR DATA MULTIPLIED BY 0.952).

TABLE 4 THE CAPTURE CROSS SECTION INTEGRAL IN THE ENERGY RANGE FROM 0.0021 EV TO 3 EV.

ENERGY RANGE (EV)	PRESENT WORK (B*EV)	ENDF/B-VI (B*EV)	WESTON AND TODD/6/ (B*EV)
0.0021-0.020	12.25	12.28(+0.2%)	
0.0200-0.030	3.67	3.68(+0.3%)	
0.0300-0.100	15.28	15.39(+0.7%)	15.27(-0.1%)
0.1000-0.500	110.58	109.47(-1.0%)	110.49(-0.1%)
0.5000-1.000	5.90	5.87(-0.5%)	6.51
1.0000-3.000	7.30	7.14(-2.2%)	8.96
0.0021-3.000	154.98	153.83(-0.7%)	
0.0300-3.000	139.06	137.87(-0.9%)	141.29(+1.6%)

WESTON AND TODD EXPERIMENTAL DATA WERE NORMALIZED TO THE CALCULATED AVERAGE CAPTURE CROSS SECTION OVER THE RESONANCE AT 0.264 EV(ORIGINAL EXFOR DATA MULTIPLIED BY 0.914); IN THE ENERGY RANGE FROM 0.5 EV TO 3 EV THE EXPERIMENTAL DATA ARE NOT ACCURATE DUE TO LARGE CORRECTIONS FOR THE IMPURITIES.

TABLE 5 THE FISSION CROSS SECTION INTEGRAL IN THE ENERGY RANGE FROM 3 EV TO 300 EV.

ENERGY RANGE (EV)	PRESENT WORK (B*EV)	ENDF/B-VI (B*EV)	WESTON AND TODD/6/ (B*EV)
3- 20	3038.63	3066.37(+0.9%)	3036.23(-0.1%)
20- 50	1683.69	1739.68(+3.3%)	1705.50(+1.3%)
50-100	1971.15	2030.10(+3.0%)	1931.50(-2.0%)
100-200	2554.85	2628.39(+2.9%)	2531.00(-0.9%)
200-300	2741.23	2820.75(+2.9%)	2747.00(+0.2%)
3-300	11989.55	12285.29(+2.5%)	11951.23(-0.3%)

WESTON AND TODD EXPERIMENTAL DATA WERE NORMALIZED TO WAGEMANS ET AL./4/ IN THE ENERGY RANGE FROM 0.1 EV TO 12 EV (ORIGINAL EXFOR DATA MULTIPLIED BY 0.952).

TABLE 6 THE CAPTURE CROSS SECTION INTEGRAL IN THE ENERGY RANGE FROM 3 EV TO 300 EV.

ENERGY RANGE (EV)	PRESENT WORK (B*EV)	ENDF/B-VI (B*EV)	WESTON AND TODD/6/ (B*EV)
3- 20	1213.07	1138.52(-6.5%)	1192.90(-1.7%)
20- 50	330.34	307.48(-7.5%)	338.09(+2.3%)
50-100	605.40	585.88(-3.2%)	594.83(-1.8%)
100-200	609.83	581.77(-4.8%)	652.68(+7.0%)
200-300	684.97	661.12(-3.6%)	700.53(+2.3%)
3-300	3443.36	3274.77(-5.1%)	3479.04(+1.0%)

WESTON AND TODD EXPERIMENTAL DATA NORMALIZED TO THE CALCULATED AVERAGE CAPTURE CROSS SECTION OVER THE RESONANCE AT 0.265 EV (ORIGINAL EXFOR DATA MULTIPLIED BY 0.914).

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MAT number = 9446
 94-PU-242 NAIG       EVAL-MAR87 T.MURATA, M.KAWAI
                      DIST-SEP89 REV2-JUN94
HISTORY
87-05 EVALUATION WAS MADE BY
        T.MURATA (NAIG): CROSS SECTIONS ABOVE RESONANCE REGION AND
                   OTHER QUANTITIES.
        M.KAWAI  (NAIG): RESONANCE PARAMETERS.
89-02 FP YIELDS WERE ADDED.
       COMPILATION WAS MADE BY T. NAKAGAWA (JAERI).
94-06 JENDL-3.2.
       NU-P, NU-D AND NU-TOTAL WERE MODIFIED.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (1,452), (1,455), (1,456)
     ***********************************************************


MF=1 GENERAL INFORMATION
  MT=451 COMMENT AND DICTIONARY
  MT=452 NUMBER OF NEUTRONS PER FISSION
       SUM OF NU-P NAD NU-D.
  MT=455 DELAYED NEUTRONS PER FISSION
       BASED ON THE EXPERIMENTAL DATA BY EVANS ET AL./1/, AND
       SYSTEMATICS BY TUTTLE/2/, BENEDETTI ET AL./3/ AND WALDO ET
       AL./4/  DECAY CONSTANTS WERE EVALUATED BY BRADY AND
       ENGLAND/5/.
  MT=456 PROMPT NEUTRONS PER FISSION
       BASED ON SYSTEMATICS BY MANERO AND KONSHIN/6/, AND BY
       HOWERTON/7/.

MF=2 RESONANCE PARAMETERS
  MT=151 RESONANCE PARAMETERS
  RESOLVED RESONANCE PARAMETERS FOR MLBW ( 1.0E-5 EV TO 1.15 KEV)
      EVALUATION FOR JENDL-2 WAS MODIFIED ON THE BASIS OF FISSION
      CROSS SECTION MEASUREMENTS BY WEIGMANN ET AL. /8/
        RES. ENERGIES         = BNL 325 (3RD) /9/
        NEUTRON AND CAPTURE WIDTHS = POORTMANS ET AL. /10/,
                                AUCHAMPAUGH ET AL./11/
        FISSION WIDTHS        = WEIGMANN ET AL. /8/
        R                     = 9.9 FM
        AVERAGE CAPTURE WIDTH = 0.0242 EV
      TWO NEGATIVE RESONANCES WERE ADDED TO REPRODUCE 2200-M/S
      CROSS SECTIONS RECOMMENDED BY MUGHABGHAB /12/
  UNRESOLVED RESONANCE PARAMETERS ( 1.15 TO 40 KEV)
      PARAMETERS WERE DETERMINED TO REPRODUCE CROSS SECTIONS
      EVALUATED AS DESCRIBED BELOW.

    CALCULATED 2200-M/S CROSS SECTIONS AND RESONANCE INTEGRALS
                      2200-M/S(B)       RES. INTEG.(B)
      TOTAL           27.11                ----
      ELASTIC          8.32                ----
      FISSION          0.00256             5.58
      CAPTURE         18.79             1130

MF=3 NEUTRON CROSS SECTIONS
      BELOW 40 KEV, REPRESENTED WITH RESONANCE PARAMETERS.

  MT=1 SIG-TOT
      BELOW 6 KEV : EXPERIMENTAL DATA OF YOUNG AND REEDER /13/
        WERE AVERAGED OVER SOME KEV ENERGY INTERVAL.
      ABOVE 6 KEV : SPLINE FITTING TO EXPERIMENTAL DATA OF
        KAEPPELER ET AL. /14/ AND MOORE ET AL. /15/

  MT=2 SIG-EL
      OBTAINED BY SUBTRACTING OTHER CROSS SECTIONS FROM TOTAL.

  MT=4 SIG-INEL
      SUM OF PARTIAL INELASTIC CROSS SECTIONS

  MT=51-91   PARTIAL SIG-INEL
      BELOW 3 MEV : THE RESULTS OF STATISTICAL AND COUPLED CHANNEL
        CALCULATION OF LAGRANGE ET AL./16/ WERE ADOPTED.
      ABOVE 3 MEV : EXTRAPOLATION OF THE VALUES WAS MADE BASED
        ON DWBA CALCULATION.

          LEVEL SCHEME
             NO.      ENERGY(MEV)         SPIN-PARITY
             G.S.       0.0                   0 +
               1        0.04285               2 +
               2        0.141685              4 +
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              3         0.294314            6 +
              4         0.4976              8 +
              5         0.59736             1 -
              6         0.64889             3 -
              7         0.74232             5 -
              8         0.8607              0 +
              9         0.90032             2 +
             10         0.93807             1 -
             11         0.95887             2 -
             12         0.9924              4 +
             13         1.0018              3 -
             14         1.0306              3 +
             15         1.0375              4 -
             16         1.0764              4 +
             17         1.0895              0 +
             18         1.1155              5 -
             19         1.1370              2 +
             20         1.1615              6 -
             21         1.1778              3 +
             22         1.223               2 +
             23         1.2325              4 +
             24         1.2408              1 -
             25         1.2621              3 +
             26         1.2820              3 -
             27         1.30873             5 -
             28         1.41079             0 +
       LEVELS ABOVE 1.41079 MEV WERE ASSUMED TO BE CONTINUUM.

MT=16,17,37 SIGMAS OF (N,2N), (N,3N) AND (N,4N)
       GIVEN BY MULTIPLICATION OF NEUTRON EMISSION CROSS SECTION
       AND BRANCHING RATIO TO EACH REACTION.  THE NEUTRON EMISSION
       CROSS SECTION WAS OBTAINED BY SUBTRACTING FISSION AND
       CAPTURE CROSS SECTIONS FROM REACTION CROSS SECTION
       CALCULATED WITH SPHERICAL OPTICAL MODEL.  THE BRANCHING
       RATIO WAS CALCULATED WITH THE FORMALISM GIVEN BY SEGEV ET
       AL./17/

MT=18 SIG-FISS
       BELOW 100 KEV : SHAPE OF SIG-FISS DETERMINED ON THE FISSION
         AREA DATA OF AUCHAMPAUGH ET AL./18/  THEN NORMALIZED TO
         THE VALUE OF HIGHER ENERGY REGION.
       ABOVE 100 KEV : FISSON RATIO TO U-235 WAS DETERMINED ON THE
         EXPERIMENTAL DATA OF BEHRENS ET AL./19/ AND MULTIPLIED BY
         U-235 FISSION CROSS SECTION /20/.

MT=102 SIG-CAP
     ENERGY REGION OF 6 KEV TO 210 KEV : DETERMINED ON THE BASIS OF
       EXPERIMENTAL DATA OF HOCHENBURY ET AL./21/ AND WISSHAK AND
       KAEPPELER /22/.
     OTHER ENERGY REGION : STATISTICAL CALCULATION RESULT WITH
       CASTHY CODE /23/ WAS NORMALIZED TO SIG-CAP IN THE REGION OF
       6 TO 210 KEV. DIRECT AND COLLECTIVE CAPTURE PROCESSES WERE
       INCLUDED IN HIGH ENERGY REGION USING THE VALUE OF U-238
       GIVEN BY KITAZAWA ET AL./24/

  ** PARAMETERS FOR THE CASTHY CODE CALCULATION
        SPHERICAL OPTICAL POTENTIAL PARAMETERS
           V=40. 1-0.05EN , WS=6.5+0.15EN , VSO=7.0  (MEV)
           R=1.32      ,   RS=1.38    ,   RSO=1.32      (FM)
           A=AS=ASO=0.47                                (FM)
        LEVEL DENSITY PARAMETERS WERE DETERMINED TO REPRODUCE THE
        RESONANCE LEVEL SPACINGS AND LEVEL SCHEME SUM STAIRCASES.

  MT=251 MU-L
        ASSUMED TO BE THE SAME AS THAT OF PU-240.

MF=4 ANGULAR DISTRIBUTIONS
        THE SAME DISTRIBUTIONS AS PU-240 WERE ASSUMED, WHICH WERE
        DETERMINED AS FOLLOWS.

  MT=2 DSIG-EL
        SPHERICAL OPTICAL MODEL CALCULATION

  MT=51 TO 91  DSIG-INEL
        FOR THE 1ST AND 2ND LEVELS THE RESULTS OF CALCULATION OF
        LAGRANGE ET AL./16/ ARE AVAILABLE AND THEIR RESULTS WERE
        ADOPTED.  FOR OTHER LEVELS, STATISTICAL PLUS DWBA CALCU-
        LATIONS WERE MADE.

MF=5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17 AND 91
        DISTRIBUTIONS WERE CALCULATED WITH PEGASUS/25/
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  MT=37
       EVAPORATION SPECTRUM WAS TAKEN FROM JENDL-2
  MT=18
       TAKEN FROM JENDL-2. TEMPERATURE WAS ESTIMATED FROM Z**2/A
       SYSTEMATICS BY SMITH ET AL. /26/

MF=8 FISSION PRODUCT YIELDS
  MT=454  INDEPENDENT YIELDS
  MT=459  CUMULATIVE YIELDS
       BOTH WERE TAKEN FROM JNDC FP DECAY DATA FILE VERSION-2/27/.
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MAT number = 9543

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 95-AM-241 JAERI      EVAL-MAR88 T.NAKAGAWA
JAERI-M 89-008        DIST-SEP89
HISTORY
82-03 EVALUATION FOR JENDL-2 WAS MADE BY Y.KIKUCHI (JAERI) /1/.
88-03 RE-EVALUATION FOR JENDL-3 WAS MADE BY T.NAKAGAWA (JAERI)
      /2/.

MF=1  GENERAL INFORMATION
  MT=451   COMMENT AND DICTIONARY
  MT=452   NUMBER OF NEUTRONS PER FISSION
            SUM OF NU-P (MT=456) AND NU-D (MT=455).
  MT=455   DELAYED NEUTRON DATA
            ESTIMATED WITH SEMI-EMPIRICAL FORMULA BY TUTTLE /3/.
  MT=456   NUMBER OF PROMPT NEUTRONS
            EXPERIMENTAL DATA OF JAFFEY AND LERNER /4/.

MF=2,MT=151   RESONANCE PARAMETERS
  RESOLVED RESONANCES FOR MLBW FORMULA : 1.0E-5 - 150 EV
        DATA OF DERRIEN AND LUCAS /5/ WERE ADOPTED AND 5 NEGATIVE
        RESONANCES WERE ADDED.  VALUES OF TOTAL SPIN J WERE
        REPLACED WITH ARBITRARILY ASSUMED VALUES.

  UNRESOLVED RESONANCES : 150 EV - 30 KEV
        PARAMETERS WERE DETERMINED BY USING ASREP/6/ SO AS TO
        REPRODUCE THE CAPTURE CROSS SECTION MEASURED BY VANPRAET
        ET AL. /7/ AND THE FISSION CROSS SECTION BY DABBS ET AL.
        /8/.
          ENERGY INDEPENDENT PARAMETERS:
            R=9.37 FM, GAM-G=0.044 EV,  DOBS=0.4 EV
          ENERGY DEPENDENT PARAMETERS:
            AT 150 EV: S0= 1.08E-4, S1=2.72E-4, WF=0.24 MILLI-EV
            AT 30 KEV: S0= 0.79E-4, S1=1.99E-4, WF=0.30 MILLI-EV

  CALCULATED 2200-M/S CROSS SECTIONS AND RESONANCE INTEGRALS
                      2200 M/S VALUE       RES. INT.
        TOTAL          614.6   B              -
        ELASTIC         11.13  B              -
        FISSION          3.018 B            13.9  B
        CAPTURE        600.4   B            1300  B

MF=3  NEUTRON CROSS SECTIONS

  MT=1,2  TOTAL AND ELASTIC SCATTERING CROSS SECTIONS
        CALCULATED WITH OPTICAL AND STATISTICAL MODELS BY USING
        CASTHY/9/.  OPTICAL POTENTIAL PARAMETERS/10/ WERE OBTAINED
        BY FITTING THE DATA OF PHILLIPS AND HOWE /11/ :
           V = 43.4 - 0.107*EN                       (MEV)
           WS= 6.95 - 0.339*EN + 0.0531*EN**2        (MEV)
           WV= 0              , VSO = 7.0            (MEV)
           R = RSO = 1.282    , RS = 1.29            (FM)
           A = ASO = 0.60     , B  = 0.5             (FM)

  MT=4,51-66,91  INELASTIC SCATTERING CROSS SECTIONS
        OPTICAL AND STATISTICAL MODEL CALCULATION WITH CASTHY CODE
        /9/.  THE LEVEL SCHEME WAS TAKEN FROM REF. /12/
                  NO          ENERGY(KEV)   SPIN-PARITY
                 G.S.              0           5/2 -
                   1             41.176        7/2 -
                   2             93.65         9/2 -
                   3            158.0         11/2 -
                   4            205.883        5/2 +
                   5            235.0          7/2 +
                   6            272.0          9/2 +
                   7            320.0         11/2 +
                   8            471.81         3/2 -
                   9            504.448        5/2 -
                  10            549.0          7/2 -
                  11            623.1          1/2 +
                  12            636.861        3/2 -
                  13            652.089        1/2 -
                  14            653.23         3/2 +
                  15            670.24         3/2 +
                  16            682.0         11/2 -
               CONTINUUM LEVELS ASSUMED ABOVE 732 KEV.
        THE LEVEL DENSITY PARAMETERS WERE DETERMINED ON THE BASIS
        OF NUMBER OF EXCITED LEVELS/13/ AND RESONANCE LEVEL
        SPACING/14/.
                                AM-242     AM-241
                    A(1/MEV)     29.6       29.0
                       T(MEV)     0.342      0.367
                    C(1/MEV)     22.98       9.95
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                 E-X(MEV)     2.323       3.122
   SPIN-CUTOFF(1/MEV**0.5)    30.85       30.45
             PAIRING E(MEV)   0.0         0.43

  MT=16,17   (N,2N) AND (N,3N) REACTION CROSS SECTIONS
        JENDL-2 DATA CALCULATED WITH EVAPORATION MODEL WERE
        ADOPTED.

  MT=18      FISSION CROSS SECTION
        EVALUATED ON THE BASIS OF THE DATA BY DABBS ET AL./8/

  MT=102     CAPTURE CROSS SECTION
        EVALUATED ON THE BASIS OF THE MEASURED DATA OF VANPRAET ET
        AL./7/ IN THE UNRESOLVED RESONANCE REGION. ABOVE 30 KEV,
        CALCULATION WITH CASTHY WAS ADOPTED.  THE GAMMA-RAY
        STRENGTH FUNCTION WAS DETERMINED SO THAT THE CROSS SECTION
        WAS 1.7 BARNS AT 60 KEV.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,51-66,91         CALCULATED WITH CASTHY.
  MT=16,17,18           ISOTROPIC IN THE LAB SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,91           EVAPORATION SPECTRUM.
  MT=18                 MAXWELLIAN FISSION SPECTRUM.  TEMPERATURE
                        WAS ESTIMATED FROM Z**2/A VALUES /15/.

MF=8 FISSION PRODUCT YIELD DATA
  MT=454   FISSION PRODUCT YIELD DATA
           TAKEN FROM ENDF/B-IV, AND RENORMALIZED TO 2.0.
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MAT number = 9546

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 95-AM-242 JAERI      EVAL-MAR80 T.NAKAGAWA, S.IGARASI
JAERI-M 8903 (1980)   DIST-SEP89
HISTORY
80-03 NEW EVALUATION WAS MADE BY T.NAKAGAWA AND S.IGARASI(JAERI).
      DETAILS ARE GIVEN IN REF. /1/.
87-04 FORMAT WAS TRANSLATED TO ENDF-5 FORMAT.
88-03 SINCE NO RECENT EXPERIMENTAL DATA WERE AVAILABLE, THE DATA
      OF JENDL-2 WERE ADOPTED FOR JENDL-3.

MF=1  GENERAL INFORMATION
  MT=451  COMMENT AND DICTIONARY
  MT=452  NUMBER OF NEUTRONS PER FISSION
           SUM OF PROMPT AND DELAYED NEUTRONS.
  MT=455  DELAYED NEUTRON DATA
           ESTIMATED FROM TUTTLE'S SEMI-EMPIRICAL FORMULA /2/.
  MT=456  NUMBER OF PROMPT NEUTRONS PER FISSION
           SEMI-EMPIRICAL FORMULA BY HOWERTON /3/
             NU-P= 3.268 + 0.172*E(MEV).

MF=2  RESONANCE PARAMETERS
  MT=151  NO RESONANCE PARAMETERS

     2200M/S CROSS SECTIONS AND CALCULATED RESONANCE INTEGRALS.
                         2200 M/SEC     RES. INTEG.
             TOTAL       7611.44 B           -
             ELASTIC       11.44 B           -
             FISSION     2100.0  B        1260 B
             CAPTURE     5500.0  B         391 B

MF=3  NEUTRON CROSS SECTIONS
  MT=1,2,4,51-72,91,102,251       SIG-T,SIG-EL,SIG-IN,SIG-C,MU-BAR
      BELOW 0.225 EV:
           1/V FORM WAS ASSUMED FOR FISSION AND CAPTURE CROSS
           SECTIONS.  EFFECTIVE SCATTERING RADIUS OF 9.54 FM WAS
           USED FOR ELASTIC SCATTERING CROSS-SECTION CALCULATION.
      ABOVE 0.225 EV:
           OPTICAL AND STATISTICAL MODELS WERE USED.
           THE SPHERICAL OPTICAL POTENTIAL PARAMETERS (MEV, FM) :
            V= 42.0 - 0.107*E , R= 1.282 , A= 0.6
            WS= 9.0 - 0.339*E + 0.0531*E**2 , R= 1.29 , A= 0.5
            VSO= 7.0 , R= 1.282 , A= 0.6
            STATISTICAL MODEL CALCULATION WITH CASTHY CODE /4/.
            COMPETING PROCESSES : FISSION,(N,2N) AND (N,3N).
            LEVEL FLUCTUATION CONSIDERED.  GAM-G = 0.05 EV AND
            D = 0.45 EV USED FOR CAPTURE CROSS SECTION CALCULATION
            THE LEVEL SCHEME TAKEN FROM THE COMPILATION BY ELLIS
            AND HAESE /5/.
              NO.      ENERGY(MEV)         SPIN-PARITY
             G.S.       0.0                  1   -
               1        0.044                0   -
               2        0.049                3   -
               3        0.049                5   -
               4        0.074                2   -
               5        0.113                6   -
               6        0.148                4   -
               7        0.148                5   -
               8        0.190                7   -
               9        0.242                3   -
              10        0.263                6   -
              11        0.263                7   -
              12        0.288                4   -
              13        0.288                2   -
              14        0.325                3   -
              15        0.341                5   -
              16        0.372                4   -
              17        0.410                6   -
              18        0.430                5   -
              19        0.488                7   -
              20        0.500                6   -
              21        0.581                7   -
              22        0.679                8   -
          OVERLAPPING LEVELS ARE ASSUMED ABOVE 0.681 MEV.
          THE LEVEL DENSITY PARAMETERS OF GILBERT AND CAMERON /6/.
  MT=16,17  (N,2N) AND (N,3N) CROSS SECTIONS
          CALCULATED WITH THE EVAPORATION MODEL BY PEARLSTEIN /7/.
  MT=18 FISSION CROSS SECTION
          THE EMPIRICAL FORMULA USED FOR THE AM-242M DATA WAS
          APPLIED BY SHIFTING THE ENERGY ORIGIN TO -49 KEV.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2     LEGENDRE COEFFICIENTS ARE GIVEN BY THE OPTICAL AND
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          STATISTICAL MODEL CALCULATIONS.
  MT=16,17,18,91 ISOTROPIC DISTRIBUTIONS IN THE CENTER-OF-MASS
          SYSTEM.
  MT=51-72 ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,91 EVAPORATION SPECTRUM
  MT=18       FISSION SPECTRUM ESTIMATED FROM Z**2/A SYSTEMATICS BY
          SMITH ET AL. /8/ BY ASSUMING E(CF-252) = 2.13 MEV.
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MAT number = 9547

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 95-AM-242MJAERI       EVAL-MAR88 T.NAKAGAWA
JAERI-M 89-008         DIST-SEP89
HISTORY
80-03 NEW EVALUATION WAS MODE BY T.NAKAGAWA AND S.IGARASI (JAERI).
      DETAILS ARE GIVEN IN REF. /1/.
88-03 RE-EVALUATION WAS MADE FOR JENDL-3 BY T.NAKAGAWA (JAERI)/2/.

MF=1  GENERAL INFORMATION
  MT=451  COMMENT AND DICTIONARY
  MT=452  NUMBER OF NEUTRONS PER FISSION
           SUM OF PROMPT AND DELAYED NEUTRONS.
  MT=455  DELAYED NEUTRON DATA
           ESTIMATED FROM TUTTLE'S SEMI-EMPIRICAL FORMULA /3/.
  MT=456  NUMBER OF PROMPT NEUTRONS PER FISSION
           BASED ON THE RELATIVE MEASUREMENTS /4,5/ TO THE U-235
           DATA, AND ON THE EMPIRICAL FORMULA BY HOWERTON /6/.

MF=2  RESONANCE PARAMETERS
  MT=151  RESONANCE PARAMETERS
      RESOLVED RESONANCE PARAMETERS : BELOW 20 EV
           PARAMETERS FOR 48 LEVELS DEDUCED BY BROWNE ET AL./7/
           AND THE SINGLE LEVEL BREIT-WIGNER FORMULA WERE ADOPTED.

      UNRESOLVED RESONANCE PARAMETERS : 20 EV - 30 KEV
           PARAMETERS WERE DETERMINED SO AS TO REPRODUCE THE
           FISSION CROSS SECTION OF BROWNE ET AL./7/.  BACKGROUND
           SIG WAS GIVEN TO THE FISSION AT LOW ENERGIES.
             AVERAGE WG = 0.05 EV, AVERAGE WF = 1.28 EV,
             D-OBS = 0.4 EV, S0 = 1.07E-4, S1 = E-DEPENDENT,
             R = 9.59 FM

     CALCULATED 2200M/S CROSS SECTIONS AND RESONANCE INTEGRALS.
                         2200 M/SEC   RES. INTEG.
             TOTAL        7969.  B         -
             ELASTIC         5.667 B       -
             FISSION      6409.  B      1560 B
             CAPTURE      1254.  B       246 B

MF=3  NEUTRON CROSS SECTIONS
  BELOW 30 KEV: CROSS SECTIONS WERE REPRESENTED WITH THE
                RESONANCE PARAMETERS.
  ABOVE 30 KEV:

  MT=1,2  TOTAL AND ELASTIC SCATTERING CROSS SECTIONS
          CALCULATED WITH OPTICAL AND STATISTICAL MODEL CODE
          CASTHY/8/.
           THE SPHERICAL OPTICAL POTENTIAL PARAMETERS (MEV, FM) :
              V= 42.0 - 0.107*E , R= 1.282 , A= 0.6
              WS= 9.0 - 0.339*E + 0.0531*E**2 , R= 1.29 , A= 0.5
              VSO= 7.0 , R= 1.282 , A= 0.6

  MT=4,51-72,91  INELASTIC SCATTERING CROSS SECTIONS
          CALCULATED WITH CASTHY/8/.  THE LEVEL SCHEME WAS TAKEN
          FROM THE COMPILATION BY ELLIS AND HAESE /9/, WITH
          SHIFTED ENERGY ORIGIN AT -49 KEV.
               NO.      ENERGY(MEV)        SPIN-PARITY
             G.S.        -0.049              1    -
               1         -0.005              0    -
               2          0.0                3    -
               3          0.0 (META STABLE)  5    -
               4          0.025              2    -
               5          0.064              6    -
               6          0.099              4    -
               7          0.099              5    -
               8          0.141              7    -
               9          0.193              3    -
              10          0.214              6    -
              11          0.214              7    -
              12          0.239              4    -
              13          0.239              2    -
              14          0.276              3    -
              15          0.292              5    -
              16          0.323              4    -
              17          0.361              6    -
              18          0.381              5    -
              19          0.439              7    -
              20          0.451              6    -
              21          0.532              7    -
              22          0.630              8    -
          OVERLAPPING LEVELS WERE ASSUMED ABOVE 0.632 MEV.
          THE LEVEL DENSITY PARAMETERS WERE DETERMINED ON THE
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          BASIS OF NUMBER OF EXCITED LEVELS/10/ AND RESONANCE
          LEVEL SPACING/11/.
                                         AM-243      AM-242
                        A(1/MEV)          31.3        29.6
                          T(MEV)          0.355       0.342
                        C(1/MEV)          11.71       22.98
                        E-X(MEV)          3.278       2.323
       SPIN-CUTOFF(1/MEV**0.5)            31.81       30.85
                 PAIRING E(MEV)           0.5         0.0

  MT=16,17  (N,2N) AND (N,3N) CROSS SECTIONS
          TAKEN FROM JENDL-2 CALCULATED WITH THE EVAPORATION MODEL
          BY PEARLSTEIN /12/.

  MT=18 FISSION CROSS SECTION
          DETERMINED BY CUBIC SPLINE-FITTING TO THE DATA MEASURED
          BY BROWNE ET AL./7/

  MT=102 CAPTURE CROSS SECTION
          CALCULATED WITH CASTHY/8/.  THE GAMMA-RAY STRENGTH
          FUNCTION WAS ESTIMATED FROM WG=0.05 EV AND D-OBS=0.4 EV.

  MT=251 MU-L BAR
          CALCULATED WITH CASTHY/8/.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,51-72,91
          LEGENDRE COEFFICIENTS WERE GIVEN BY THE OPTICAL AND
          STATISTICAL MODEL CALCULATIONS.
  MT=16,17,18
          ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,91 EVAPORATION SPECTRUM WITH NUCLEAR TEMPERATURE
          CALCULATED FROM LEVEL DENSITIES.
  MT=18   FISSION SPECTRUM ESTIMATED FROM Z**2/A SYSTEMATICS BY
          SMITH ET AL. /13/ BY ASSUMING E(CF-252) = 2.13 MEV.
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MAT number = 9549
 95-AM-243 JAERI       EVAL-MAR88 T.NAKAGAWA
JAERI-M 89-008         DIST-SEP89
HISTORY
77-03 NEW EVALUATION WAS MADE BY S.IGARASI AND T.NAKAGAWA (JAERI).
      DETAILS ARE GIVEN IN REF. /1/.
82-03 COMPLETE REEVALUATION FOR JENDL-2 WAS MADE BY Y.KIKUCHI
      (JAERI).  DETAILS ARE GIVEN IN REF. /2/.
88-03 REEVALUATED FOR JENDL-3 WAS MADE BY T.NAKAGAWA (JAERI)/3/.

MF=1  GENERAL INFORMATION
  MT=451   COMMENT AND DICTIONARY
  MT=452   NUMBER OF NEUTRONS PER FISSION
              SUM OF NU-P (MT=456) AND NU-D (MT=455).
  MT=455   DELAYED NEUTRON DATA
              ESTIMATED WITH SEMI-EMPIRICAL FORMULA BY TUTTLE /4/.
  MT=456   NUMBER OF PROMPT NEUTRONS
              ESTIMATED FROM SYSTEMATICS. SAME AS PREVIOUS EVALUA-
              TION /1/.

MF=2,MT=151   RESONANCE PARAMETERS
  RESOLVED RESONANCES FOR MLBW FORMULA : 1.0E-5 - 215 EV.
        JENDL-2 EVALUATION/2/ WAS BASED ON THE DATA OF SIMPSON ET
        AL./5/.  THE FISSION WIDTHS WERE MODIFIED FOR JENDL-3 ON
        THE BASIS OF KNITTER AND BUDTZ-JORGENSEN/6/.  VALUES OF
        TOTAL SPIN WERE ASSUMED ARBITRARILY.

  UNRESOLVED RESONANCES : 215 EV - 30 KEV
        PARAMETERS OF JENDL-2 WERE ADOPTED.
           OBTAINED FROM OPTICAL MODEL CALCULATION:
              S0=0.93E-4, S1=2.44E-4, R=9.34 FM
           ESTIMATED FROM RESOLVED RESONANCES:
                DOBS=0.67 EV, WG=0.039 EV, WF=0.00012 EV

  CALCULATED 2200-M/S CROSS SECTIONS AND RESONANCE INTEGRALS
                        2200 M/S VALUE       RES. INT.
        TOTAL             86.10  B               -
        ELASTIC            7.483 B               -
        FISSION           0.1161 B             7.59  B
        CAPTURE           78.50  B             1830  B

MF=3  NEUTRON CROSS SECTIONS
  BELOW 30 KEV: CROSS SECTIONS WERE REPRESENTED WITH THE
                RESONANCE PARAMETERS.
  ABOVE 30 KEV:

  MT=1,2  TOTAL AND ELASTIC SCATTERING CROSS SECTIONS
        CALCULATED WITH OPTICAL AND STATISTICAL MODEL CODE
        CASTHY/7/.  OPTICAL POTENTIAL PARAMETERS WERE OBTAINED /8/
        BY FITTING THE DATA OF PHILLIPS AND HOWE /9/ FOR AM-241:
           V = 43.4 - 0.107*EN                        (MEV)
           WS= 6.95 - 0.339*EN + 0.0531*EN**2         (MEV)
           VSO = 7.0                                  (MEV)
           R = RSO = 1.282   , RS = 1.29              (FM)
           A = ASO = 0.60    , B  = 0.5               (FM)

  MT=4,51-59,91  INELASTIC SCATTERING CROSS SECTIONS
        CALCULATED WITH CASTHY/8/.  THE LEVEL SCHEME WAS TAKEN
        FROM REF. /10/
                   NO         ENERGY(KEV)   SPIN-PARITY
                  G.S.             0           5/2 -
                   1              42.2         7/2 -
                   2              84.0         5/2 +
                   3              96.4         9/2 -
                   4             109.3         7/2 +
                   5             143.5         9/2 +
                   6             189.3        11/2 +
                   7             266.0         3/2 -
                   8             300.0         5/2 -
                   9             345.0         7/2 -
                CONTINUUM LEVELS ASSUMED ABOVE 383 KEV.
        THE LEVEL DENSITY PARAMETERS WERE DETERMINED ON THE BASIS
        OF NUMBER OF EXCITED LEVELS/11/ AND RESONANCE LEVEL
        SPACING/12/.
                                 AM-244      AM-243
                   A(1/MEV)       30.3        31.3
                     T(MEV)       0.340       0.355
                   C(1/MEV)       26.47       11.71
                   E-X(MEV)       2.373       3.278
       SPIN-CUTOFF(1/MEV**0.5)    31.39       31.81
                PAIRING E(MEV)    0.0         0.5
```

```
  MT=16,17,37  (N,2N), (N,3N) AND (N,4N) REACTION CROSS SECTIONS
        TAKEN FROM JENDL-2 CALCULATED WITH THE EVAPORATION MODEL.

  MT=18  FISSION CROSS SECTION
        30 KEV - 100 KEV :  SMOOTH CORVE CONNECTING THE DATA IN
            THE UNRESOLVED RESONANCE REGION AND ABOVE 100 KEV
        100 KEV - 10 MEV : SPLINE-FITTING TO KANDA ET AL./13/,
            FURSOV ET AL./14/ AND KNITTER AND BUDTZ-JORGENSEN/6/.
        10 MEV - 20 MEV : SHAPE WAS ESTIMATED ON THE BASIS OF
            BEHRENS AND BROWNE/15/


  MT=102 CAPTURE CROSS SECTION
          CALCULATED WITH CASTHY/8/.  THE GAMMA-RAY STRENGTH
          FUNCTION WAS DETERMINED TO REPRODUCE THE CROSS SECTION
          OF 2.2 B AT 30 KEV/16/.

  MT=251 MU-L BAR
          CALCULATED WITH CASTHY/8/.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,51-59,91
          LEGENDRE COEFFICIENTS WERE GIVEN BY THE OPTICAL AND
          STATISTICAL MODEL CALCULATION.
  MT=16,17,18,37
          ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,37,91
          EVAPORATION SPECTRUM WITH NUCLEAR TEMPERATURE CALCULATED
          FROM LEVEL DENSITIES.
  MT=18
          MAXWELLIAN FISSION SPECTRUM ESTIMATED FROM Z**2/A
          SYSTEMATICS BY SMITH ET AL./17/.

MF=8  FISSION PRODUCT YIELD DATA
  MT=454  FISSION PRODUCT YIELD DATA
          TAKEN FROM ENDF/B-IV AND RENORMALIZED TO 2.0.
```

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```
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17) SMITH A.B.: ANL/NDM-50 (1979).
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MAT number = 9552

```
 95-AM-244 JAERI       EVAL-MAR88 T.NAKAGAWA
JAERI-M 89-008         DIST-SEP89
HISTORY
88-03 EVALUATED FOR JENDL-3 WAS MADE BY T.NAKAGAWA (JAERI)/1/.

MF=1  GENERAL INFORMATION
  MT=451   COMMENT AND DICTIONARY
  MT=452   NUMBER OF NEUTRONS PER FISSION
        SUM OF NU-P (MT=456) AND NU-D (MT=455).
  MT=455   DELAYED NEUTRON DATA
        ESTIMATED FROM SEMI-EMPIRICAL FORMULA BY TUTTLE /2/.
  MT=456   NUMBER OF PROMPT NEUTRONS
        ESTIMATED FROM SEMI-EMPIRICAL FORMULA BY HOWERTON/3/.

MF=2,MT=151   RESONANCE PARAMETERS
  NO RESONANCE PARAMETERS WERE GIVEN.

  2200-M/S CROSS SECTIONS AND RESONANCE INTEGRALS
                     2200 M/S VALUE       RES. INT.
        TOTAL         2912.  B              -
        ELASTIC         11.62 B             -
        FISSION       2300.  B            1260  B
        CAPTURE        600.  B             316  B

MF=3  NEUTRON CROSS SECTIONS
  MT=1  TOTAL CROSS SECTION
        BELOW 0.07 EV, SUM OF PARTIAL CROSS SECTIONS.  ABOVE 0.07
        EV, CALCULATED WITH OPTICAL AND STATISTICAL MODEL CODE
        CASTHY/4/. THE SAME OPTICAL POTENTIAL PARAMETERS AS THOSE
        FOR AM-242 WHICH WERE OBTAINED /5/ BY FITTING THE DATA OF
        PHILLIPS AND HOWE /6/ FOR AM-241, AND MODIFIED A LITTLE.
           V = 42.0 - 0.107*EN                         (MEV)
           WS= 9.0  - 0.339*EN + 0.0531*EN**2          (MEV)
           VSO = 7.0                                   (MEV)
           R = RSO = 1.282   , RS = 1.29               (FM)
           A = ASO = 0.60    , B  = 0.5                (FM)

  MT=2  ELASTIC SCATTERING CROSS SECTION
        CALCULATED WITH CASTHY/4/.

  MT=4,51-75,91  INELASTIC SCATTERING CROSS SECTIONS
        CALCULATED WITH CASTHY/4/.  THE LEVEL SCHEME WAS TAKEN
        FROM REF. /7/
                   NO         ENERGY(KEV)   SPIN-PARITY
                  G.S.            0           6 -
                    1            88.0         1 +
                    2           100.309       2 +
                    3           123.281       3 +
                    4           148.283       4 +
                    5           175.657       1 -
                    6           183.511       5 -
                    7           197.295       2 -
                    8           228.299       3 -
                    9           261.696       2 -
                   10           272.202       4 -
                   11           289.212       1 -
                   12           296.658       3 -
                   13           322.751       5 -
                   14           355.575       0 -
                   15           342.650       3 -
                   16           343.658       4 -
                   17           348.405       3 +
                   18           361.838       2 -
                   19           377.057       0 +
                   20           390.028       4 +
                   21           398.743       5 -
                   22           414.689       2 +
                   23           418.957       2 +
                   24           420.131       2 +
                   25           421.204       3 -
          LEVELS ABOVE 435 KEV WERE ASSUMED TO BE OVERLAPPING.
        THE LEVEL DENSITY PARAMETERS WERE DETERMINED ON THE BASIS
        OF NUMBER OF EXCITED LEVELS/8/ AND RESONANCE LEVEL
        SPACING/9/.
                                AM-245      AM-244
                     A(1/MEV)    31.3        30.3
                       T(MEV)    0.360       0.340
                     C(1/MEV)    18.06       26.47
                     E-X(MEV)    3.265       2.373
       SPIN-CUTOFF(1/MEV**0.5)   31.98       31.39
                PAIRING E(MEV)   0.39        0.0
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```
  MT=16,17,37  (N,2N), (N,3N) AND (N,4N) REACTION CROSS SECTIONS
        CALCULATED WITH EVAPORATION MODEL.

  MT=18  FISSION CROSS SECTION
        BELOW 0.07 EV, 1/V SHAPED CROSS SECTION WAS NORMALIZED TO
        2300 +- 300 B AT 0.0253 EV/9/.  ABOVE 0.07 EV, THE CROSS
        SECTION WAS ASSUMED TO BE THE SAME AS THAT OF AM-242G
        (MAT=3952 OF JENDL-3).

  MT=102 CAPTURE CROSS SECTION
        BELOW 0.07 EV, 1/V CROSS SECTION WAS NORMALIZED TO 600 B
        AT 0.0253 EV THAT WAS ESTIMATED BY ASSUMING THE SAME CROSS
        SECTION RATIO AS HIGHER ENERGY REGION.  ABOVE 0.07 EV,
        CALCULATED WITH CASTHY/4/.  THE GAMMA-RAY STRENGTH
        FUNCTION WAS DETERMINED FROM D-OBS=0.13 EV CALCULATED FROM
        LEVEL DENSITY PARAMETERS AND WG=0.05 EV.

  MT=251 MU-L BAR
        CALCULATED WITH CASTHY/4/.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,51-75,91
          LEGENDRE COEFFICIENTS WERE GIVEN BY THE OPTICAL AND
          STATISTICAL MODEL CALCULATION.
  MT=16,17,18,37
          ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,37,91
          EVAPORATION SPECTRUM WITH NUCLEAR TEMPERATURE CALCULATED
          FROM LEVEL DENSITIES.
  MT=18
          MAXWELLIAN FISSION SPECTRUM ESTIMATED FROM Z**2/A
          SYSTEMATICS BY SMITH ET AL./10/.
```

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```
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 8) ENSDF, EVALUATED NUCLEAR STRUCTURE DATA FILE (1988).
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    ACADEMIC PRESS, INC. (1984).
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MAT number = 9553

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 95-AM-244MJAERI         EVAL-MAR88 T.NAKAGAWA
JAERI-M 89-008           DIST-SEP89
HISTORY
88-03 EVALUATED FOR JENDL-3 WAS MADE BY T.NAKAGAWA (JAERI)/1/.

MF=1  GENERAL INFORMATION
  MT=451   COMMENT AND DICTIONARY
  MT=452   NUMBER OF NEUTRONS PER FISSION
        SUM OF NU-P (MT=456) AND NU-D (MT=455).
  MT=455   DELAYED NEUTRON DATA
        ESTIMATED FROM SEMI-EMPIRICAL FORMULA BY TUTTLE /2/.
  MT=456   NUMBER OF PROMPT NEUTRONS
        ESTIMATED FROM SEMI-EMPIRICAL FORMULA BY HOWERTON/3/.

MF=2,MT=151   RESONANCE PARAMETERS
  NO RESONANCE PARAMETERS WERE GIVEN.

  2200-M/S CROSS SECTIONS AND RESONANCE INTEGRALS
                      2200 M/S VALUE       RES. INT.
        TOTAL          2012.  B               -
        ELASTIC          11.62 B              -
        FISSION        1600.  B             1260  B
        CAPTURE         400.  B              316  B

MF=3  NEUTRON CROSS SECTIONS
  MT=1  TOTAL CROSS SECTION
        BELOW 0.07 EV, SUM OF PARTIAL CROSS SECTIONS.  ABOVE 0.07
        EV, CALCULATED WITH OPTICAL AND STATISTICAL MODEL CODE
        CASTHY/4/. THE SAME OPTICAL POTENTIAL PARAMETERS AS THOSE
        FOR AM-242 WHICH WERE OBTAINED /5/ BY FITTING THE DATA OF
        PHILLIPS AND HOWE /6/ FOR AM-241, AND MODIFIED A LITTLE.
           V = 42.0 - 0.107*EN                        (MEV)
           WS= 9.0  - 0.339*EN + 0.0531*EN**2         (MEV)
           VSO = 7.0                                  (MEV)
           R = RSO = 1.282    , RS = 1.29             (FM)
           A = ASO = 0.60     , B  = 0.5              (FM)

  MT=2  ELASTIC SCATTERING CROSS SECTION
        CALCULATED WITH CASTHY/4/.

  MT=4,51-75,91   INELASTIC SCATTERING CROSS SECTIONS
        CALCULATED WITH CASTHY/4/.  THE LEVEL SCHEME WAS TAKEN
        FROM REF. /7/ AND SHIFTED BY 88 KEV.
                   NO          ENERGY(KEV)    SPIN-PARITY
                    1             -88.0          6 -
                   TARGET S.        0.0          1 +
                    2              12.309        2 +
                    3              35.281        3 +
                    4              60.283        4 +
                    5              87.657        1 -
                    6              95.511        5 -
                    7             109.295        2 -
                    8             140.299        3 -
                    9             173.696        2 -
                   10             184.202        4 -
                   11             201.212        1 -
                   12             208.658        3 -
                   13             234.751        5 -
                   14             247.575        0 -
                   15             254.650        3 -
                   16             255.658        4 -
                   17             260.405        3 +
                   18             273.838        2 -
                   19             289.057        0 +
                   20             302.028        4 +
                   21             310.743        5 -
                   22             326.689        2 +
                   23             330.957        2 +
                   24             332.131        2 +
                   25             333.204        3 -
           LEVELS ABOVE 447 KEV WERE ASSUMED TO BE OVERLAPPING.
        THE LEVEL DENSITY PARAMETERS WERE DETERMINED ON THE BASIS
        OF NUMBER OF EXCITED LEVELS/8/ AND RESONANCE LEVEL
        SPACING/9/.
                                    AM-245      AM-244
                         A(1/MEV)    31.3        30.3
                           T(MEV)    0.360       0.340
                         C(1/MEV)    18.06       26.47
                         E-X(MEV)    3.265       2.373
       SPIN-CUTOFF(1/MEV**0.5)      31.98       31.39
                    PAIRING E(MEV)    0.39        0.0
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```
  MT=16,17,37  (N,2N), (N,3N) AND (N,4N) REACTION CROSS SECTIONS
        CALCULATED WITH EVAPORATION MODEL.

  MT=18  FISSION CROSS SECTION
        BELOW 0.07 EV, 1/V SHAPED CROSS SECTION WAS NORMALIZED TO
        1600 +- 300 B AT 0.0253 EV/9/.  ABOVE 0.07 EV, THE CROSS
        SECTION WAS ASSUMED TO BE THE SAME AS THAT OF AM-242G
        (MAT=3952 OF JENDL-3).

  MT=102 CAPTURE CROSS SECTION
        BELOW 0.07 EV, 1/V CROSS SECTION WAS NORMALIZED TO 400 B
        AT 0.0253 EV THAT WAS ESTIMATED BY ASSUMING THE SAME CROSS
        SECTION RATIO AS HIGHER ENERGY REGION.  ABOVE 0.07 EV,
        CALCULATED WITH CASTHY/4/.  THE GAMMA-RAY STRENGTH
        FUNCTION WAS DETERMINED FROM D-OBS=0.13 EV CALCULATED FROM
        LEVEL DENSITY PARAMETERS AND WG=0.05 EV.

  MT=251 MU-L BAR
        CALCULATED WITH CASTHY/4/.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,51-75,91
          LEGENDRE COEFFICIENTS WERE GIVEN BY THE OPTICAL AND
          STATISTICAL MODEL CALCULATION.
  MT=16,17,18,37
          ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,37,91
          EVAPORATION SPECTRUM WITH NUCLEAR TEMPERATURE CALCULATED
          FROM LEVEL DENSITIES.
  MT=18
          MAXWELLIAN FISSION SPECTRUM ESTIMATED FROM Z**2/A
          SYSTEMATICS BY SMITH ET AL./10/.
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REFERENCES


```
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 7) SHURSHIKOV E.N.: NUCL. DATA SHEETS, 49, 785 (1986).
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 9) MUGHABGHAB S.F.: "NEUTRON CROSS SECTIONS, VOL. 1, PART B",
    ACADEMIC PRESS, INC. (1984).
10) SMITH A.B.: ANL/NDM-50 (1979).
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MAT number = 9628

```
 96-CM-241 JAERI       EVAL-MAR89 T.NAKAGAWA
                       DIST-SEP89
HISTORY
89-03 EVALUATION FOR JENDL-3 WAS MADE BY T. NAKAGAWA(JAERI)/1/.

MF=1  GENERAL INFORMATION
  MT=451  DESCRIPTIVE DATA
  MT=452  NUMBER OF NEUTRONS PER FISSION
      SUM OF MT=455 AND MT=456
  MT=455  DELAYED NEUTRON DATA
      ESTIMATED FROM THE SYSTEMATICS BY TUTTLE /2/.
  MT=456  NUMBER OF PROMPT NEUTRONS PER FISSION
      BASED ON THE EMPIRICAL FORMULA BY HOWERTON /3/.

MF=2  RESONANCE PARAMETERS
  MT=151  NO RESONANCE PARAMETERS WERE GIVEN.

  CALCULATED 2200M/S CROSS SECTIONS AND RESONANCE INTEGRALS.
                           2200 M/SEC    RES. INTEG.
             TOTAL          851.9 B        ---
             ELASTIC         11.9 B        ---
             FISSION        700.0 B        969 B
             CAPTURE        140.0 B        160 B

MF=3  NEUTRON CROSS SECTIONS

  BELOW 1 EV:
    THIS ENERGY RANGE WAS ASSUMED TO BE THE THERMAL REGION, AND
    FISSION AND CAPTURE CROSS SECTIONS WITH 1/V SHAPE WERE GIVEN
    AND ELASTIC SCATTERING WITH A CONSTANT VALUE.  THE TOTAL CROSS
    SECTION IS A SUM OF THEM.

  ABOVE 1 EV:

  MT=1,2,4,51-54,91,102,251   TOTAL, ELASTIC AND INELASTIC
     SCATTERING, CAPTURE CROSS SECTIONS AND MU-L
        CALCULATED WITH OPTICAL AND STATISTICAL MODEL CODE
        CASTHY/4/.
        THE SPHERICAL OPTICAL POTENTIAL PARAMETERS (MEV,FM):
           V  =42.0-0.107*EN,                R  =1.282, A  =0.60
           WS =6.95-0.339*EN+0.0531*EN**2, RS =1.29,  B  =0.50
                (DERIVATIVE WOODS-SAXON FORM)
           VSO=7.0,                          RSO=1.282, ASO=0.60
        THIS SET OF POTENTIAL PARAMETERS WAS DETERMINED /5/ TO
        REPRODUCE WELL THE TOTAL CROSS SECTION OF AM-241 BY
        PHILLIPS AND HOWE /6/, AND A REAL PART WAS MODIFIED A
        LITTLE TO GIVE A SLIGHTLY HIGH REACTION CROSS SECTIONS IN
        A LOW ENERGY REGION.

        IN THE STATISTICAL MODEL CALCULATION, COMPETING PROCESSES
        OF FISSION, (N,2N) AND (N,3N), AND LEVEL FLUCTUATION WERE
        CONSIDERED.  THE LEVEL SCHEME OF CM-241 WAS TAKEN FROM THE
        COMPILATION BY ELLIS-AKOVALI /7/:
              NO.      ENERGY(MEV)         SPIN-PARITY
             G.S.        0.0                 1/2 +
               1         0.0530              3/2 +
               2         0.103               5/2 +
               3         0.157               7/2 +
               4         0.255               9/2 +
        OVERLAPPING LEVELS WERE ASSUMED ABOVE 0.35 MEV.  THE LEVEL
        DENSITY PARAMETERS WERE DETERMINED ON THE BASIS OF NUMBERS
        OF EXCITED LEVELS.
                                 CM-242    CM-241
                      A(1/MEV)    28.0      28.57
                        T(MEV)    0.40      0.378
                      C(1/MEV)    2.5771    5.287
                      E-X(MEV)    4.3163    3.560
       SPIN-CUTOFF(1/MEV**0.5)    30.00     30.22
                PAIRING E(MEV)    0.15      0.72

        AVERAGE RADIATIVE WIDTH = 0.040 EV AND D = 6.6 EV OBTAINED
        FROM THE LEVEL DENSITY PARAMETERS WERE USED FOR THE
        CAPTURE CROSS SECTION CALCULATION.

  MT=16, 17  (N,2N) AND (N,3N) CROSS SECTIONS
        CALCULATED WITH THE EVAPORATION MODEL BY PEARLSTEIN /8/.
        NEUTRON EMISSION CROSS SECTION WAS ASSUMED TO BE (COMPOUND
        NUCLEUS FORMATION CROSS SECTION CALCULATED WITH OPTICAL
        MODEL - FISSION).

  MT=18 FISSION CROSS SECTION
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        THE SAME CROSS SECTION AS CM-243 /1/ WAS ASSUMED.  BELOW 1
        KEV, STRUCTURE WAS REPLACED WITH A SMOOTH CURVE.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,51-54,91
          LEGENDRE COEFFICIENTS CALCULATED WITH THE OPTICAL AND
          STATISTICAL MODELS WERE GIVEN.
  MT=16,17,18
          ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,91 EVAPORATION SPECTRUM.
  MT=18   ESTIMATED FROM Z**2/A SYSTEMATICS BY SMITH ET AL. /9/,
          ASSUMING E(CF-252) = 2.13 MEV.

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```

```
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 7) ELLIS-AKOVALI Y.A.: NUCL. DATA SHEETS, 44, 407 (1985).
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MAT number = 9631

```
 96-CM-242 JAERI      EVAL-MAR89 T.NAKAGAWA
                      DIST-SEP89
HISTORY
79-03 EVALUATION FOR JENDL-2 WAS MADE BY S.IGARASI AND T.NAKAGAWA
      (JAERI) /1/.
89-03 RE-EVALUATION FOR JENDL-3 WAS MADE BY T.NAKAGAWA(JAERI)/2/.

MF=1  GENERAL INFORMATION
  MT=451  DESCRIPTIVE DATA
  MT=452  NUMBER OF NEUTRONS PER FISSION
        SUM OF MT=455 AND MT=456.
  MT=455  DELAYED NEUTRON DATA
        ESTIMATED FROM THE SYSTEMATICS BY TUTTLE /3/.
  MT=452  NUMBER OF NEUTRONS PER FISSION
        BASED ON THE EMPIRICAL FORMULA BY HOWERTON /4/.

MF=2  RESONANCE PARAMETERS
  MT=151  RESONANCE PARAMETERS
     RESOLVED RESONANCE REGION : 1.0E-5 EV TO 275 EV.
          RESONANCE ENERGIES = ALTAMONOV ET AL. /5/,
          NEUTRON WIDTHS     = ALTAMONOV ET AL. /5/,
          RADIATIVE WIDTHS   = 0.040 EV,
          FISSION WIDTHS     = ALAM ET AL. /6/ FOR THE LOW-LYING 4
                        LEVELS, AND THE AVERAGE VALUE OF 0.004 EV
                        FOR OTHER LEVELS.
          SCATTERING RADIUS  = 9.38 FM.
        A NEGATIVE RESONANCE WAS ADDED AT -3.45 EV, AND ITS
        PARAMETERS WERE ADJUSTED SO AS TO REPRODUCE WELL THE
        THERMAL CROSS SECTIONS/7/.  BACKGROUND CROSS SECTION WAS
        GIVEN TO THE FISSION CROSS SECTION.
     UNRESOLVED RESONANCE PARAMETERS : 275 EV - 40 KEV
        PARAMETERS WERE DETERMINED WITH A FITTING CODE ASREP /8/
        SO AS TO REPRODUCE THE FISSION CROSS SECTION MEASURED BY
        ALAM ET AL./6/, AND TOTAL CROSS SECTION AT 40 KEV.
          ENERGY INDEPENDENT PARAMETERS:
            R=9.093 FM, S0=0.92E-4, S2=0.97E-4, WG=0.04 EV.
          ENERGY DEPENDENT PARAMETERS AT 1 KEV:
            S1=3.04E-4, WF=0.093 EV, D=17.16 EV.

     CALCULATED 2200M/S CROSS SECTIONS AND RESONANCE INTEGRALS.
                             2200 M/SEC    RES. INTEG.
             TOTAL           32.57  B        ---
             ELASTIC         11.61  B        ---
             FISSION          5.064 B        20.0 B
             CAPTURE         15.90  B       109   B

MF=3  NEUTRON CROSS SECTIONS
     BELOW 40 KEV, CROSS SECTIONS WERE REPRESENTED WITH RESONANCE
     PARAMETERS.

  MT=1,2,4,51-53,91,102,251   TOTAL, ELASTIC AND INELASTIC
     SCATTERING, CAPTURE CROSS SECTIONS AND MU-L
        CALCULATED WITH OPTICAL AND STATISTICAL MODEL CODE
        CASTHY/9/.
        THE SPHERICAL OPTICAL POTENTIAL PARAMETERS (MEV,FM):
           V  =43.4-0.107*EN,              R  =1.282, A  =0.60
           WS =6.95-0.339*EN+0.0531*EN**2, RS =1.29,  B  =0.50
                (DERIVATIVE WOODS-SAXON FORM)
           VSO=7.0,                        RSO=1.282, ASO=0.60
        THIS SET OF POTENTIAL PARAMETERS WAS DETERMINED /1/ TO
        REPRODUCE WELL THE TOTAL CROSS SECTION OF AM-241 BY
        PHILLIPS AND HOWE /10/.

        IN THE STATISTICAL MODEL CALCULATION, COMPETING PROCESSES
        OF FISSION, (N,2N) AND (N,3N), AND LEVEL FLUCTUATION WERE
        CONSIDERED.  THE LEVEL SCHEME OF CM-242 WAS TAKEN FROM
        ENSDF /11/:
              NO.      ENERGY(MEV)        SPIN-PARITY
             G.S.        0.0                 0 +
               1         0.04213             2 +
               2         0.138               4 +
               3         0.284               6 +
        OVERLAPPING LEVELS ARE ASSUMED ABOVE 0.35 MEV.  THE LEVEL
        DENSITY PARAMETERS WERE DETERMINED ON THE BASIS OF NUMBERS
        OF EXCITED LEVELS/11/.
                                   CM-243     CM-242
                      A(1/MEV)      28.0       28.0
                        T(MEV)      0.40       0.40
                      C(1/MEV)      7.5405     2.5771
                      E-X(MEV)      3.8863     4.3163
       SPIN-CUTOFF(1/MEV**0.5)      30.08      30.00
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               PAIRING E(MEV)    0.72      0.15

       AVERAGE RADIATIVE WIDTH = 0.040 EV AND D = 18 EV OBTAINED
       FROM THE LEVEL DENSITY PARAMETERS WERE USED FOR THE
       CAPTURE CROSS SECTION CALCULATION.

  MT=16, 17  (N,2N) AND (N,3N) CROSS SECTIONS
       CALCULATED WITH THE EVAPORATION MODEL BY PEARLSTEIN /12/.
       NEUTRON EMISSION CROSS SECTION WAS ASSUMED TO BE (COMPOUND
       NUCLEUS FORMATION CROSS SECTION CALCULATED WITH OPTICAL
       MODEL - FISSION).

  MT=18 FISSION CROSS SECTION
       BELOW 1 MEV, CROSS SECTION WAS DETERMINED ON THE BASIS OF
       DATA MEASURED BY ALAM ET AL./6/ AND VOROTNIKOV ET AL./13/.
       ABOVE 1 MEV, JENDL-2 EVALUATION WAS ADOPTED, WHICH WAS
       BASED ON THE SHAPE OF CM-244 /14/ AND THE EMPIRICAL
       FORMULA ON THE FISSION-CROSS-SECTION SYSTEMATICS AROUND 4
       MEV BY BEHRENS AND HOWERTON /15/.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,51-53,91
       LEGENDRE COEFFICIENTS CALCULATED WITH THE OPTICAL AND
       STATISTICAL MODELS WERE GIVEN.
  MT=16,17,18
       ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,91 EVAPORATION SPECTRUM.
  MT=18   ESTIMATED FROM Z**2/A SYSTEMATICS BY SMITH ET AL. /16/,
          ASSUMING E(CF-252) = 2.13 MEV.
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MAT number = 9634

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 96-CM-243 JAERI      EVAL-MAR89 T.NAKAGAWA
                      DIST-SEP89
HISTORY
81-03 EVALUATION FOR JENDL-2 WAS MADE BY T.NAKAGAWA AND S.IGARASI
      (JAERI) /1/.
89-03 RE-EVALUATION FOR JENDL-3 WAS MADE BY T.NAKAGAWA (JAERI)/2/.

MF=1  GENERAL INFORMATION
  MT=451  DESCRIPTIVE DATA
  MT=452  NUMBER OF NEUTRONS PER FISSION
        SUM OF MT=455 AND MT=456.
  MT=455  DELAYED NEUTRON DATA
        ESTIMATED FROM THE SYSTEMATICS BY TUTTLE /3/.
  MT=456  NUMBER OF PROMPT NEUTRONS PER FISSION
        BASED ON THE EXPERIMENTAL DATA AT THERMAL ENERGY BY JAFFEY
        AND LERNER /4/, AND ZHURAVLEV ET AL. /5/, AND ON THE
        EMPIRICAL FORMULA BY HOWERTON /6/.

MF=2  RESONANCE PARAMETERS
  MT=151  RESONANCE PARAMETERS
     RESOLVED RESONANCE REGION (SLBW): 1.0E-5 EV TO 70 EV.
          RESONANCE ENERGIES = ANUFRIEV ET AL. /7/
          NEUTRON WIDTHS     = ANUFRIEV ET AL. /7/ (ASSUMING 2G=1)
          RADIATIVE WIDTHS   = 0.040 EV (ASSUMED)
          FISSION WIDTHS     = TOTAL WIDTH /7/ - (WN+WG)
          SCATTERING RADIUS  = 10 FM.
        A NEGATIVE RESONANCE WAS ADOPTED SO AS TO REPRODUCE WELL
        THE THERMAL CROSS SECTIONS/8/.
     UNRESOLVED RESONANCE PARAMETERS : 70 EV - 40 KEV
        PARAMETERS WERE DETERMINED WITH A FITTING CODE ASREP/9/ SO
        AS TO REPRODUCE THE FISSION CROSS SECTION BASED ON SILBERT
        /10/, AND THE TOTAL CROSS SECTION CALCULATED WITH OPTICAL
        MODEL.
          ENERGY INDEPENDENT PARAMETERS:
            R=9.810 FM, S2=1.70E-4, WG=0.04 EV, WF=1.481 EV
          ENERGY DEPENDENT PARAMETERS AT 1 KEV:
            S0=1.32E-4, S1=1.06E-4, D=0.799 EV.

      CALCULATED 2200M/S CROSS SECTIONS AND RESONANCE INTEGRALS.
                         2200 M/SEC    RES. INTEG.
              TOTAL       757.5  B         -
              ELASTIC       9.926 B        -
              FISSION     617.4  B      1560 B
              CAPTURE     130.2  B       199 B

MF=3  NEUTRON CROSS SECTIONS
     BELOW 40 KEV, CROSS SECTIONS WERE REPRESENTED WITH RESONANCE
     PARAMETERS.

  MT=1,2,4,51-63,91,102,251   TOTAL, ELASTIC AND INELASTIC
     SCATTERING, CAPTURE CROSS SECTIONS AND MU-L
        CALCULATED WITH OPTICAL AND STATISTICAL MODEL CODE
        CASTHY/11/.
        THE SPHERICAL OPTICAL POTENTIAL PARAMETERS (MEV,FM):
           V  =41.0-0.107*EN,             R  =1.282, A  =0.60
           WS =6.95-0.339*EN+0.0531*EN**2, RS =1.29,  B  =0.50
                (DERIVATIVE WOODS-SAXON FORM)
           VSO=7.0,                       RSO=1.282, ASO=0.60
        THIS SET OF POTENTIAL PARAMETERS WAS DETERMINED /12/ TO
        REPRODUCE WELL THE TOTAL CROSS SECTION OF AM-241 BY
        PHILLIPS AND HOWE /13/, AND A REAL PART WAS MODIFIED A
        LITTLE TO GIVE A SLIGHTLY LARGE STRENGTH FUNCTION IN A LOW
        ENERGY REGION.

        IN THE STATISTICAL MODEL CALCULATION, COMPETING PROCESSES
        OF FISSION, (N,2N), (N,3N) AND (N,4N), AND LEVEL
        FLUCTUATION WERE CONSIDERED.  THE LEVEL SCHEME OF CM-243
        WAS TAKEN FROM THE COMPILATION BY ELLIS-AKOVALI /14/:
              NO.      ENERGY(MEV)       SPIN-PARITY
             G.S.        0.0              5/2  +
               1         0.042            7/2  +
               2         0.0874           1/2  +
               3         0.094            9/2  +
               4         0.094            3/2  +
               5         0.133            7/2  +
               6         0.153           11/2  +
               7         0.164            9/2  +
               8         0.219           13/2  +
               9         0.228           11/2  +
              10         0.260            9/2  +
              11         0.530           15/2  -
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             12        0.729              1/2  -
             13        0.769              3/2  -
      OVERLAPPING LEVELS ARE ASSUMED ABOVE 0.82 MEV.  THE LEVEL
      DENSITY PARAMETERS WERE DETERMINED ON THE BASIS OF NUMBERS
      OF EXCITED LEVELS/15/ AND RESONANCE LEVEL SPACING/8/.
                                CM-244    CM-243
                   A(1/MEV)      28.0      28.0
                     T(MEV)      0.395     0.40
                   C(1/MEV)      1.8807    7.5405
                   E-X(MEV)      4.2893    3.8863
     SPIN-CUTOFF(1/MEV**0.5)     30.17     30.08
             PAIRING E(MEV)      1.22      0.72

      AVERAGE RADIATIVE WIDTH = 0.040 EV AND D = 0.809 EV /7/
      WERE USED FOR THE CAPTURE CROSS SECTION CALCULATION.

  MT=16,17,37  (N,2N),(N,3N) AND (N,4N) CROSS SECTIONS
      CALCULATED WITH THE EVAPORATION MODEL BY PEARLSTEIN/16/.
      NEUTRON EMISSION CROSS SECTION WAS ASSUMED TO BE (COMPOUND
      NUCLEUS FORMATION CROSS SECTION CALCULATED WITH OPTICAL
      MODEL - FISSION).

  MT=18 FISSION CROSS SECTION
      BELOW 10 KEV  : TAKEN FROM JENDL-2 EVALUATION BASED ON
                      SILBERT /10/.
      10 KEV - 3 MEV: DETERMINED FROM FOMUSHKIN ET AL. /17/.
      ABOVE 3 MEV   : ESTIMATED.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,51-63,91
      LEGENDRE COEFFICIENTS CALCULATED WITH CASTHY /11/.
  MT=16,17,18,37
      ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,37,91 EVAPORATION SPECTRUM.
  MT=18    FISSION SPECTRUM ESTIMATED FROM Z**2/A SYSTEMATICS BY
           SMITH ET AL. /18/ BY ASSUMING E(CF-252) = 2.13 MEV.
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MAT number = 9637

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 96-CM-244 JAERI      EVAL-MAR89 T.NAKAGAWA
                      DIST-SEP89
HISTORY
77-03 EVALUATION FOR JENDL-2 WAS MADE BY S.IGARASI AND T.NAKAGAWA
      (JAERI) /1/.
89-03 RE-EVALUATION FOR JENDL-3 WAS MADE BY T.NAKAGAWA(JAERI)/2/.

MF=1  GENERAL INFORMATION
  MT=451  DESCRIPTIVE DATA
  MT=452  NUMBER OF NEUTRONS PER FISSION
        SUM OF MT=455 AND MT=456.
  MT=455  NUMBER OF DELAYED NEUTRONS PER FISSION
        ESTIMATED FROM SEMI-EMPIRICAL FORMULA BY TUTTLE /3/.
  MT=456  NUMBER OF PROMPT NEUTRONS PER FISSION
        DETERMINED FROM SEMI-EMPIRICAL FORMULA BY HOWERTON /4/.

MF=2  RESONANCE PARAMETERS
  MT=151  RESONANCE PARAMETERS
     RESOLVED RESONANCE REGION (MLBW) : 1.0E-5 TO 1 KEV
        ABOVE 20 EV, PARAMETERS BY MOORE AND KEYWORTH /5/ WERE
        ADOPTED ASSUMING NEUTRON WIDTH OF 0.2 EV FOR 646.9, 759.7,
        914.0 AND 971.5-EV LEVELS, AND BELOW 20 EV, EVALUATION BY
        BENJAMIN ET AL. /6/.  THE FISSION WIDTHS OF LOW-LYING 4
        LEVELS WERE REPLACED WITH THOSE BY MAGUIRE ET AL. /7/.
          RADIATIVE WIDTH   = 0.037 EV (ASSUMED)
          SCATTERING RADIUS = 11.2 FM (ADJUSTED TO 11.6 B
                              AT 0.0253 EV /8/.
        A NEGATIVE RESONANCE AT -1.48 EV WAS ADOPTED AND ITS
        PARAMETERS WERE ADJUSTED SO AS TO REPRODUCE WELL THE
        THERMAL CROSS SECTIONS/8/.
     UNRESOLVED RESONANCE PARAMETERS : 70 EV - 40 KEV
        PARAMETERS WERE DETERMINED WITH A FITTING CODE ASREP/9/ SO
        AS TO REPRODUCE THE FISSION CROSS SECTION OF MAGUIRE ET
        AL. /7/, AND THE TOTAL AND CAPTURE CROSS SECTIONS CALCU-
        LATED WITH OPTICAL AND STATISTICAL MODELS.
          ENERGY INDEPENDENT PARAMETERS:
            R=9.221 FM, S0=0.9E-4, S2=0.92E-4, WG=0.04 EV.
          ENERGY DEPENDENT PARAMETERS AT 1 KEV:
            S1=3.06E-4, WF=0.00244 EV, D=11.98 EV.

     CALCULATED 2200M/S CROSS SECTIONS AND RESONANCE INTEGRALS.
                          2200 M/SEC      RES. INTEG.
             TOTAL         27.20  B            -
             ELASTIC       11.06  B            -
             FISSION        1.037 B          13.2 B
             CAPTURE       15.10  B         661   B

MF=3  NEUTRON CROSS SECTIONS
     BELOW 40 KEV, CROSS SECTIONS WERE REPRESENTED WITH RESONANCE
     PARAMETERS.

  MT=1,2,4,51-62,91,102,251   TOTAL, ELASTIC AND INELASTIC
     SCATTERING, CAPTURE CROSS SECTIONS AND MU-L
        CALCULATED WITH OPTICAL AND STATISTICAL MODEL CODE
        CASTHY/10/.
        THE SPHERICAL OPTICAL POTENTIAL PARAMETERS (MEV,FM):
           V  =43.4-0.107*EN,                R  =1.282, A  =0.60
           WS =6.95-0.339*EN+0.0531*EN**2, RS =1.29,  B  =0.50
               (DERIVATIVE WOODS-SAXON FORM)
           VSO=7.0,                          RSO=1.282, ASO=0.60
        THIS SET OF POTENTIAL PARAMETERS WAS DETERMINED /11/ TO
        REPRODUCE WELL THE TOTAL CROSS SECTION OF AM-241 BY
        PHILLIPS AND HOWE /12/.  THE STRENGTH FUNCTION OF 0.91E-4
        CALCULATED WITH THIS OMP IS IN VERY GOOD AGREEMENT WITH
        EXPERIMENTS/8/.

        IN THE STATISTICAL MODEL CALCULATION, COMPETING PROCESSES
        OF FISSION, (N,2N) AND (N,3N), AND LEVEL
        FLUCTUATION WERE CONSIDERED.  THE LEVEL SCHEME OF CM-244
        WAS TAKEN FROM THE COMPILATION BY SHURSHIKOV /13/:
              NO.      ENERGY(MEV)        SPIN-PARITY
             G.S.        0.0                 0    +
               1         0.04297             2    +
               2         0.14235             4    +
               3         0.29621             6    +
               4         0.50179             8    +
               5         0.970               2    +
               6         0.98491             0    +
               7         1.0208              2    +
               8         1.038               2    +
               9         1.0402              6    +
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              10         1.0842              1    +
              11         1.1059              1    -
              12         1.187               2    +
        OVERLAPPING LEVELS ARE ASSUMED ABOVE 1.2 MEV.  THE LEVEL
        DENSITY PARAMETERS WERE DETERMINED ON THE BASIS OF NUMBERS
        OF EXCITED LEVELS/14/ AND RESONANCE LEVEL SPACING/8/.
                                CM-245    CM-244
                   A(1/MEV)      30.0      28.0
                     T(MEV)      0.391     0.395
                   C(1/MEV)      11.288    1.8807
                   E-X(MEV)      4.0295    4.2893
       SPIN-CUTOFF(1/MEV**0.5)   31.31     30.17
              PAIRING E(MEV)     0.72      1.22

        AVERAGE RADIATIVE WIDTH = 0.037 EV AND D = 12 EV
        WERE USED FOR THE CAPTURE CROSS SECTION CALCULATION.

  MT=16,17  (N,2N) AND (N,3N) CROSS SECTIONS
        CALCULATED WITH THE EVAPORATION MODEL BY PEARLSTEIN /15/.
        NEUTRON EMISSION CROSS SECTION WAS ASSUMED TO BE (COMPOUND
        NUCLEUS FORMATION CROSS SECTION CALCULATED WITH OPTICAL
        MODEL - FISSION).

  MT=18 FISSION CROSS SECTION
        BELOW 100 KEV: SMOOTH CURVE BASED ON MAGUIRE ET AL. /7/.
        100 - 800 KEV: JENDL-2 WAS ADOPTED, WHICH WAS OBTAINED BY
                       FITTING A SEMI-EMPIRICAL FORMULA TO THE
                       EXPERIMENTAL DATA OF REF. /5/.
        0.8 - 8 MEV  : ESTIMATED FROM EXPERIMENTAL DATA/5,16,17/
        ABOVE 8 MEV  : THE SAME AS JENDL-2.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,51-62,91
        LEGENDRE COEFFICIENTS WERE GIVEN BY THE OPTICAL AND
        STATISTICAL MODEL CALCULATIONS.
  MT=16,17,18
        ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,91 EVAPORATION SPECTRUM
  MT=18    FISSION SPECTRUM ESTIMATED FROM Z**2/A SYSTEMATICS BY
           SMITH ET AL. /18/ BY ASSUMING E(CF-252) = 2.13 MEV.
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MAT number = 9640

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 96-CM-245 JAERI      EVAL-MAR89 T.NAKAGAWA
                      DIST-MAR89 REV2-SEP92
HISTORY
78-03 EVALUATION WAS MADE BY S.IGARASI AND T.NAKAGAWA (JAERI)/1/.
89-03 RE-EVALUATION FOR JENDL-3 WAS MADE BY T.NAKAGAWA(JAERI)/2/.
90-07 SPIN IN MF2,MT151 WAS CORRECTED.
92-09 JENDL-3.2.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (1,452), (1,456)
     ***********************************************************


MF=1  GENERAL INFORMATION
  MT=451  DESCRIPTIVE DATA
  MT=452  NUMBER OF NEUTRONS PER FISSION
        SUM OF MT=455 AND MT=456.
  MT=455  NUMBER OF DELAYED NEUTRONS PER FISSION
        ESTIMATED FROM THE SYSTEMATICS PROPOSED BY TUTTLE /3/.
  MT=456  NUMBER OF PROMPT NEUTRONS PER FISSION
        EXPERIMENTAL RESULTS OF KHOKHLOV ET AL./4/ WERE ADOPTED.

MF=2  RESONANCE PARAMETERS
  MT=151  RESONANCE PARAMETERS
     RESOLVED RESONANCE REGION (SLBW) : 1.0E-5 TO 60 EV
        PARAMETERS FOR REICH-MOORE FORMULA BY MOORE AND KEYWORTH
        /5/ WERE ADOPTED ABOVE 20 EV, AND THOSE BY BROWNE ET AL.
        /6/ BELOW 20 EV WITH A LITTLE MODIFICATION OF A NEGATIVE
        RESONANCE SO THAT THE THERMAL CROSS SECTION COULD BE IN
        AGREEMENT WITH THE EXPERIMENTAL DATA.  THE DIFFERENCES
        BETWEEN REICH-MOORE AND SINGLE-LEVEL B-W FORMULAS ARE
        TREATED AS THE BACKGROUND CROSS SECTIONS.
          RADIATIVE WIDTH   = 0.04 EV
          SCATTERING RADIUS = 10.0 FM
     UNRESOLVED RESONANCE PARAMETERS : 60 EV - 40 KEV
        PARAMETERS WERE DETERMINED WITH A FITTING CODE ASREP/7/
        SO AS TO REPRODUCE THE FISSION CROSS SECTION OF MOORE AND
        KEYWORTH /5/, AND THE TOTAL AND CAPTURE CROSS SECTIONS
        CALCULATED WITH OPTICAL AND STATISTICAL MODELS.
          ENERGY INDEPENDENT PARAMETERS:
            R=9.43 FM, S0=1.02E-4, S1=2.24E-4, S2=0.9E-4,
            WG=0.04 EV.
          ENERGY DEPENDENT PARAMETERS AT 1 KEV:
            WF=2.01 EV, D=1.397 EV.

     CALCULATED 2200M/S CROSS SECTIONS AND RESONANCE INTEGRALS.
                         2200 M/SEC       RES. INTEG.
             TOTAL       2359.   B           -
             ELASTIC       11.59 B           -
             FISSION     2001.   B          801 B
             CAPTURE      346.4  B          110 B

MF=3  NEUTRON CROSS SECTIONS
     BELOW 40 KEV, CROSS SECTIONS WERE REPRESENTED WITH RESONANCE
     PARAMETERS.

  MT=1,2,4,51-73,91,102,251   TOTAL, ELASTIC AND INELASTIC
     SCATTERING, CAPTURE CROSS SECTIONS AND MU-L
        CALCULATED WITH OPTICAL AND STATISTICAL MODEL CODE
        CASTHY/8/.
        THE SPHERICAL OPTICAL POTENTIAL PARAMETERS (MEV,FM):
           V  =42.7-0.107*EN,                R  =1.282, A  =0.60
           WS =6.95-0.339*EN+0.0531*EN**2, RS =1.29,  B  =0.50
               (DERIVATIVE WOODS-SAXON FORM)
           VSO=7.0,                          RSO=1.282, ASO=0.60
        THIS SET OF POTENTIAL PARAMETERS WAS DETERMINED /9/ TO
        REPRODUCE WELL THE TOTAL CROSS SECTION OF AM-241 BY
        PHILLIPS AND HOWE /10/.  THE STRENGTH FUNCTION OF 1.02E-4
        CALCULATED WITH THIS OMP IS IN GOOD AGREEMENT WITH
        1.18E-4/11/.

        IN THE STATISTICAL MODEL CALCULATION, COMPETING PROCESSES
        OF FISSION, (N,2N), (N,3N) AND (N,4N), AND LEVEL
        FLUCTUATION WERE CONSIDERED.  THE LEVEL SCHEME OF CM-245
        WAS TAKEN FROM THE COMPILATION BY ELLIS-AKOVALI /12/:
              NO.      ENERGY(MEV)        SPIN-PARITY
             G.S.        0.0                 7/2 +
               1         0.0548              9/2 +
               2         0.1215             11/2 +
               3         0.1974             13/2 +
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4	0.25285	5/2 +
5	0.2958	7/2 +
6	0.35086	9/2 +
7	0.35595	1/2 +
8	0.3615	3/2 +
9	0.3883	9/2 -
10	0.4167	11/2 +
11	0.4188	5/2 +
12	0.431	5/2 +
13	0.4429	11/2 -
14	0.498	13/2 +
15	0.5091	13/2 -
16	0.532	9/2 +
17	0.555	11/2 +
18	0.63365	3/2 -
19	0.6435	7/2 -
20	0.66155	5/2 -
21	0.7018	9/2 -
22	0.722	7/2 +
23	0.741	1/2 +

OVERLAPPING LEVELS ARE ASSUMED ABOVE 0.82 MEV. LEVELS WITH HIGHER SPIN THAN 13/2 OR WHOSE SPIN WAS UNKNOWN WERE NEGLECTED. THE LEVEL DENSITY PARAMETERS WERE DETERMINED ON THE BASIS OF NUMBERS OF EXCITED LEVELS/13/ AND RESONANCE LEVEL SPACING/11/.

	CM-246	CM-245
A(1/MEV)	27.7	30.0
T(MEV)	0.395	0.391
C(1/MEV)	2.2560	11.288
E-X(MEV)	4.1307	4.0295
SPIN-CUTOFF(1/MEV**0.5)	30.17	31.31
PAIRING E(MEV)	1.11	0.72

AVERAGE RADIATIVE WIDTH = 0.040 EV AND D = 1.4 EV /11/ WERE USED FOR THE CAPTURE CROSS SECTION CALCULATION.

MT=16,17,37 (N,2N), (N,3N) AND (N,4N) CROSS SECTIONS
CALCULATED WITH THE EVAPORATION MODEL BY PEARLSTEIN /14/. NEUTRON EMISSION CROSS SECTION WAS ASSUMED TO BE (COMPOUND NUCLEUS FORMATION CROSS SECTION CALCULATED WITH OPTICAL MODEL - FISSION).

MT=18 FISSION CROSS SECTION
BELOW 100 KEV: JENDL-2 WAS ADOPTED, WHICH WAS OBTAINED BY FITTING A SEMI-EMPIRICAL FORMULA TO THE EXPERIMENTAL DATA OF REF./5/.
ABOVE 100 KEV: BASED ON THE EXPERIMENTAL DATA OF WHITE AND BROWNE /15/.

MF=4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=2,51-73,91
LEGENDRE COEFFICIENTS WERE GIVEN BY THE OPTICAL AND STATISTICAL MODEL CALCULATIONS.
MT=16,17,18,37
ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM.

MF=5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=16,17,37,91 EVAPORATION SPECTRUM
MT=18 FISSION SPECTRUM ESTIMATED FROM Z**2/A SYSTEMATICS BY SMITH ET AL./16/ BY ASSUMING E(CF-252) = 2.13 MEV.

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MAT number = 9643
 96-CM-246 JAERI      EVAL-MAR87 Y.KIKUCHI, T.NAKAGAWA
                      DIST-SEP89
HISTORY
87-03 NEW EVALUATION WAS MADE BY Y.KIKUCHI (JAERI) /1/.
89-03 RE-EVALUATION FOR JENDL-3 WAS MADE BY T.NAKAGAWA(JAERI) /2/.

MF=1
MF=1  GENERAL INFORMATION
  MT=451  DESCRIPTIVE DATA
  MT=452  NUMBER OF NEUTRONS PER FISSION
        SUM OF MT=455 AND MT=456.
  MT=455  NUMBER OF DELAYED NEUTRONS
        SEMI-EMPIRICAL FORMULA BY TUTTLE /3/.
  MT=456  NUMBER OF PROMPT NEUTRONS PER FISSION
        SEMI-EMPIRICAL FORMULA BY HOWERTON /4/.

MF=2  RESONANCE PARAMETERS
  MT=151  RESONANCE PARAMETERS
     RESOLVED RESONANCE REGION (MLBW) : 1.0E-5 TO 330 EV
        EVALUATION WAS BASED ON THE EXPERIMENTAL DATA /5-9/ AS
        FOLLOWS:
          RESONANCE ENERGIES = REFS. 6 AND 8.
          NEUTRON WIDTHS     = REFS. 5, 6 AND 7.
          RADIATIVE WIDTHS   = REFS. 6 AND 8, AND AVERAGE WIDTH
                         OF 0.031 EV WAS ASSUMED.
          FISSION WIDTHS     = REFS. 8 AND 9.  WF OF 4.315-EV
                         LEVEL WAS ADJUSTED TO THE THERMAL CROSS
                         SECTION.
          SCATTERING RADIUS  = 9.85 FM. (ADJUSTED TO 11.1 B AT
                         0.0253 EV/10/)
        1/V BACKGROUND DATA WERE GIVEN TO FISSION CROSS SECTION.
     UNRESOLVED RESONANCE REGION : 330 EV TO 30 KEV
        OBTAINED FROM OPTICAL MODEL CALCULATION:
          S0=0.94E-4, S1=3.17E-4, S2=0.88E-4, R=9.15 FM.
        ESTIMATED FROM RESOLVED RESONANCES:
          D-OBS=31.7 EV, WG=31 MILLI-EV.
        WF OBTAINED BY FITTING THE DATA OF STOPA ET AL./9/.

     CALCULATED 2200 M/S CROSS SECTIONS AND RESONANCE INTEGRALS
                        2200 M/SEC       RES. INTEG.
           TOTAL          12.51 B            -
           ELASTIC        11.08 B            -
           FISSION         0.14 B           9.90 B
           CAPTURE         1.291 B          113  B

MF=3  NEUTRON CROSS SECTIONS
     BELOW 30 KEV, CROSS SECTIONS WERE REPRESENTED WITH RESONANCE
     PARAMETERS.

  MT=1,2,4,51-79,91,102,251   TOTAL, ELASTIC AND INELASTIC
     SCATTERING, CAPTURE CROSS SECTIONS AND MU-L
        CALCULATED WITH OPTICAL AND STATISTICAL MODEL CODE
        CASTHY/11/.
        THE SPHERICAL OPTICAL POTENTIAL PARAMETERS (MEV,FM):
           V  =43.4-0.107*EN,               R  =1.282, A  =0.60
           WS =6.95-0.339*EN+0.0531*EN**2, RS =1.29,  B  =0.50
                (DERIVATIVE WOODS-SAXON FORM)
           VSO=7.0,                         RSO=1.282, ASO=0.60
        THIS SET OF POTENTIAL PARAMETERS WAS DETERMINED /12/ TO
        REPRODUCE WELL THE TOTAL CROSS SECTION OF AM-241 BY
        PHILLIPS AND HOWE /13/.

        IN THE STATISTICAL MODEL CALCULATION, COMPETING PROCESSES
        OF FISSION, (N,2N), (N,3N) AND (N,4N), AND LEVEL
        FLUCTUATION WERE CONSIDERED.  THE LEVEL SCHEME OF CM-246
        WAS TAKEN FROM REF./14/.
                   NO.        ENERGY(KEV)   SPIN-PARITY
                  G.S.            0             0 -
                    1            42.85          2 +
                    2           141.99          4 +
                    3           295.5           6 +
                    4           500.0           8 +
                    5           841.7           2 -
                    6           876.4           3 -
                    7           923.3           4 -
                    8           981.0           5 -
                    9          1051             6 -
                   10          1079             1 -
                   11          1105             2 -
                   12          1124             2 +
                   13          1128             3 -
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14	1129	7 -
15	1165	3 +
16	1175	0 +
17	1179	8 -
18	1211	2 +
19	1220	4 +
20	1250	1 -
21	1289	0 +
22	1300	3 -
23	1318	2 +
24	1349	1 -
25	1367	2 -
26	1379	4 +
27	1452	1 +
28	1478	2 +
29	1509	3 +

CONTINUUM LEVELS ASSUMED ABOVE 1526 KEV.

THE LEVEL DENSITY PARAMETERS WERE TAKEN FROM GILBERT AND CAMERON /15/. THE GAMMA-RAY STRENGTH FUNCTION OF 9.76E-4 DEDUCED FROM RESONANCE PARAMETERS.

MT=16,17,37 (N,2N), (N,3N), (N,4N) REACTION CROSS SECTIONS
CALCULATED WITH EVAPORATION MODEL/16/.

MT=18 FISSION
EVALUATED ON THE BASIS OF THE MEASURED DATA BY STOPA ET AL./9/ AND FOMUSHKIN ET AL./17/.

MF=4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=2,51-79,91
LEGENDRE COEFFICIENTS WERE GIVEN BY THE OPTICAL AND STATISTICAL MODEL CALCULATIONS.
MT=16,17,18,37
ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM.

MF=5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=16,17,37,91 EVAPORATION SPECTRUM
MT=18 FISSION SPECTRUM
TEMPERATURE OF 1.48 MEV WAS ESTIMATED FROM DATA OF ZHURAVLAV ET AL. /18/ FOR CM-245 AND CM-247.

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MAT number = 9646

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 96-CM-247 JAERI       EVAL-MAR89 T.NAKAGAWA, Y.KIKUCHI
                       DIST-MAR89
HISTORY
83-03 EVALUATION WAS BY Y.KIKUCHI(JAERI)/REF.1/.
89-03 RE-EVALUATION WAS MADE FOR JENDL-3 BY T.NAKAGAWA(JAERI)/2/.

MF=1  GENERAL INFORMATION
  MT=451  DESCRIPTIVE DATA
  MT=452  NUMBER OF NEUTRONS PER FISSION
        SUM OF MT=455 AND MT=456.
  MT=455   NUMBER OF DELAYED NEUTRONS PER FISSION
        SEMI-EMPIRICAL FORMULA BY TUTTLE /3/.
  MT=456  NUMBER OF PROMPT NEUTRONS PER FISSION
        THERMAL VALUE OF ZHURAVLEV ET AL./4/ AND ENERGY DEPENDENT
        TERM OF HOWERTON /5/.

MF=2  RESONANCE PARAMETERS
  MT=151  RESONANCE PARAMETERS
     RESOLVED RESONANCE REGION (MLBW) : 1.0E-5 TO 60 EV
        EVALUATION WAS BASED ON THE EXPERIMENTAL DATA OF MOORE AND
        KEYWORTH /6/ AND BELANOVA ET AL./7/.  THE PARAMETERS OF
        1.25-EV LEVEL WERE TAKEN FROM MUGHAGGHAB /8/.
          RADIATIVE WIDTHS   = 0.040 EV WAS ASSUMED.
          SCATTERING RADIUS  = 9.14 FM.
        A NEGATIVE RESONANCE WAS ADDED AT -0.3 EV.
     UNRESOLVED RESONANCE REGION : 60 EV TO 30 KEV
        PARAMETERS WERE DETERMINED WITH A FITTING CODE ASREP/9/
        SO AS TO REPRODUCE THE FISSION CROSS SECTION OF MOORE AND
        KEYWORTH /6/, AND THE TOTAL AND CAPTURE CROSS SECTIONS
        CALCULATED WITH OPTICAL AND STATISTICAL MODELS.
          ENERGY INDEPENDENT PARAMETERS:
            R=9.386 FM, S2=0.86E-4, WG=0.04 EV,,
            WF(4-)=0.0534 EV, WF(5-)=0.5 EV,  WF(3+)=0.08 EV,
            WF(4+)=0.68 EV,   WF(5+)=0.05 EV, WF(6+)=0.47 EV.
                WF ESTIMATED BY SYSTEMATIC SURVEY /10/
          ENERGY DEPENDENT PARAMETERS AT 0.9 KEV:
            S0=0.774E-4, S1=2.89E-4, D=1.397 EV.

  CALCULATED 2200 M/S CROSS SECTIONS AND RESONANCE INTEGRALS
                       2200 M/SEC      RES. INTEG.
             TOTAL       147.8  B            -
             ELASTIC       8.775 B           -
             FISSION      81.79 B         612  B
             CAPTURE      57.20 B         535  B

MF=3  NEUTRON CROSS SECTIONS
     BELOW 30 KEV, CROSS SECTIONS WERE REPRESENTED WITH RESONANCE
     PARAMETERS.

  MT=1,2,4,51-60,91,102,251   TOTAL, ELASTIC AND INELASTIC
     SCATTERING, CAPTURE CROSS SECTIONS AND MU-L
        CALCULATED WITH OPTICAL AND STATISTICAL MODEL CODE
        CASTHY/11/.
        THE SPHERICAL OPTICAL POTENTIAL PARAMETERS (MEV,FM):
           V  =43.4-0.107*EN,              R  =1.282, A  =0.60
           WS =6.95-0.339*EN+0.0531*EN**2, RS =1.29,  B  =0.50
               (DERIVATIVE WOODS-SAXON FORM)
           VSO=7.0,                        RSO=1.282, ASO=0.60
        THIS SET OF POTENTIAL PARAMETERS WAS DETERMINED /12/ TO
        REPRODUCE WELL THE TOTAL CROSS SECTION OF AM-241 BY
        PHILLIPS AND HOWE /13/.

        IN THE STATISTICAL MODEL CALCULATION, COMPETING PROCESSES
        OF FISSION, (N,2N), (N,3N) AND (N,4N), AND LEVEL
        FLUCTUATION WERE CONSIDERED.  THE LEVEL SCHEME OF CM-247
        WAS TAKEN FROM REF./14/.
                   NO.        ENERGY(KEV)   SPIN-PARITY
                  G.S.            0            9/2 -
                    1            61.5         11/2 -
                    2           133           13/2 -
                    3           227            5/2 +
                    4           266            7/2 +
                    5           285            7/2 +
                    6           317            9/2 +
                    7           342            9/2 +
                    8           404            1/2 +
                    9           433            3/2 +
                   10           449            5/2 +
                CONTINUUM LEVELS ASSUMED ABOVE 479 KEV.
        THE LEVEL DENSITY PARAMETERS WERE TAKEN FROM GILBERT AND
        CAMERON/15/.  THE GAMMA-RAY STRENGTH FUNCTION OF 2.29E-2
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        WAS DEDUCED FROM RESONANCE PARAMETERS.

  MT=16,17,37  (N,2N), (N,3N) AND (N,4N) REACTION CROSS SECTIONS
        CALCULATED WITH EVAPORATION MODEL/16/.

  MT=18  FISSION
        EVALUATED ON THE BASIS OF THE MEASURED DATA BY MOORE AND
        KEYWORTH /6/ BELOW 50 KEV.  ABOVE THIS ENERGY, THE DATA OF
        FOMUSHKIN ET AL./17/ WERE ADOPTED.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,51-60,91
        LEGENDRE COEFFICIENTS WERE GIVEN BY THE OPTICAL AND
        STATISTICAL MODEL CALCULATIONS.
  MT=16,17,18,37
        ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,37,91 EVAPORATION SPECTRUM
  MT=18     FISSION SPECTRUM
        TEMPERATURE OF 1.47 MEV WAS ESTIMATED FROM DATA OF
        ZHURAVLEV ET AL. /4/.
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MAT number = 9649

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 96-CM-248 JAERI      EVAL-MAR84 Y.KIKUCHI AND T.NAKAGAWA
JAERI-M 84-116        DIST-SEP89
HISTORY
84-03 NEW EVALUATION FOR JENDL-3 WAS MADE BY Y.KIKUCHI AND
      T.NAKAGAWA (JAERI).  DETAILS ARE GIVEN IN REF. /1/.

MF=1  GENERAL INFORMATION
  MT=451  COMMENTS AND DICTIONARY
  MT=452  NUMBER OF NEUTRONS PER FISSION
        SUM OF MT=455 AND MT=456.
  MT=455  NUMBER OF DELAYED NEUTRONS PER FISSION
        SEMI-EMPIRICAL FORMULA BY TUTTLE /2/.
  MT=456  NUMBER OF NEUTRONS PER FISSION
        SEMI-EMPIRICAL FORMULA BY HOWERTON /3/.

MF=2  RESONANCE PARAMETERS
  MT=151  RESONANCE PARAMETERS
     RESOLVED RESONANCE REGION (MLBW) : 1.0E-5 TO 1.5 KEV
        RESONANCE ENERGIES, NEUTRON AND RADIATIVE WIDTHS WERE
        TAKEN FROM THE EXPERIMENTAL DATA OF BENJAMIN ET AL./4/.
        FOR RESONANCES WHOSE RADIATIVE WIDTH WAS UNKNOWN, THE
        AVERAGE VALUE OF 0.026 EV /4/ WAS ADOPTED.  FISSION WIDTHS
        AND THE AVERAGE FISSION WIDTH OF 0.0013 EV WERE ADOPTED
        FROM MOORE AND KEYWORTH /5/.  THE AVERAGE FISSION WIDTH
        WAS USED FOR ALL RESONANCES OF WHICH FISSION WIDTH HAD NOT
        BEEN MEASURED.  R=9.1 FM WAS ASSUMED TO REPRODUCE THE
        POTENTIAL SCATTERING CROSS SECTION OF 10.4 BARNS ASSUMED
        BY BENJAMIN ET AL./4/.  THE NEUTRON WIDTH OF THE FIRST
        RESONANCE WAS SLIGHTLY ADJUSTED TO REPRODUCE THE CAPTURE
        CROSS SECTION OF 2.57 BARNS AT 0.0253 EV.  BACKGROUND
        CROSS SECTIONS WERE GIVEN ONLY FOR THE FISSION AND TOTAL
        CROSS SECTIONS BY ASSUMING THE FORM OF 1/V.  THE THERMAL
        CROSS SECTIONS TO BE REPRODUCED WERE ESTIMATED FROM
        AVAILABLE EXPERIMENTAL DATA.
     UNRESOLVED RESONANCE REGION : 1.5 KEV TO 30 KEV
        OBTAINED FROM OPTICAL MODEL CALCULATION:
          S1=3.32E-4, S2=0.844E-4, R=8.88 FM.
        ESTIMATED FROM RESOLVED RESONANCES:
          D-OBS=40.0 EV, GAM-G=26 MILLI-EV, S0=1.2E-4
        GAM-F OBTAINED BY FITTING THE DATA OF STOPA ET AL./6/.

  CALCULATED 2200 M/S CROSS SECTIONS AND RESONANCE INTEGRALS
                   2200 M/S VALUE          RES. INT.
      TOTAL           9.455  B                -
      ELASTIC         6.514  B                -
      FISSION         0.370  B               17.5  B
      CAPTURE         2.570  B              260.   B

MF=3  NEUTRON CROSS SECTIONS
     BELOW 30 KEV, CROSS SECTIONS WERE REPRESENTED WITH RESONANCE
     PARAMETERS.

  MT=1,2,4,51-58,91,102,251   TOTAL, ELASTIC AND INELASTIC
     SCATTERING, CAPTURE CROSS SECTIONS AND MU-L
        CALCULATED WITH OPTICAL AND STATISTICAL MODEL CODE
        CASTHY/7/.
        THE SPHERICAL OPTICAL POTENTIAL PARAMETERS (MEV,FM):
           V  =43.4-0.107*EN,              R  =1.282, A  =0.60
           WS =6.95-0.339*EN+0.0531*EN**2, RS =1.29,  B  =0.50
                (DERIVATIVE WOODS-SAXON FORM)
           VSO=7.0,                        RSO=1.282, ASO=0.60
        THIS SET OF POTENTIAL PARAMETERS WAS DETERMINED /8/ TO
        REPRODUCE WELL THE TOTAL CROSS SECTION OF AM-241 BY
        PHILLIPS AND HOWE /9/.

        IN THE STATISTICAL MODEL CALCULATION, COMPETING PROCESSES
        OF FISSION, (N,2N), (N,3N) AND (N,4N), AND LEVEL
        FLUCTUATION WERE CONSIDERED.  THE LEVEL SCHEME OF CM-248
        WAS TAKEN FROM REF./10/.
                 NO.         ENERGY(KEV)   SPIN-PARITY
                G.S.             0             0 +
                  1             43.40          2 +
                  2            143.6           4 +
                  3            297             6 +
                  4            510             8 +
                  5           1048             2 +
                  6           1050             1 -
                  7           1084             0 +
                  8           1094             3 -
                CONTINUUM LEVELS ASSUMED ABOVE 1126 KEV.
        THE LEVEL DENSITY PARAMETERS : GILBERT AND CAMERON /11/.
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        GAMMA-RAY STRENGTH FUNCTION OF 6.5E-4 DEDUCED FROM
        RESONANCE PARAMETERS.

  MT=16,17,37  (N,2N), (N,3N) AND (N,4N) REACTION CROSS SECTIONS
        CALCULATED WITH EVAPORATION MODEL/12/.

  MT=18  FISSION
        EVALUATED ON THE BASIS OF THE MEASURED DATA BY STOPA ET
        AL./6/ AND FOMUSHKIN ET AL./13/.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,51-58            CALCULATED WITH OPTICAL MODEL.
  MT=16,17,18,37,91     ISOTROPIC IN THE LABORATORY SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,37,91        EVAPORATION SPECTRUM.
  MT=18                 MAXWELLIAN FISSION SPECTRUM.
                        TEMPERATURE ESTIMATED FROM SYSTEMATICS OF
                        SMITH ET AL./14/.
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MAT number = 9652
 96-CM-249 JAERI      EVAL-MAR84 Y.KIKUCHI AND T.NAKAGAWA
JAERI-M 84-116        DIST-SEP89 REV2-SEP92
HISTORY
84-03 NEW EVALUATION FOR JENDL-3 WAS MADE BY Y.KIKUCHI AND
      T.NAKAGAWA (JAERI).  DETAILS ARE GIVEN IN REF. /1/.
92-09 JENDL-3.2
      COMPILED BY T.NAKAGAWA

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (5,18)   VALUE OF ZA WAS CORRECTED.
     ***********************************************************


MF=1  GENERAL INFORMATION
  MT=451  COMMENTS AND DICTIONARY
  MT=452  NUMBER OF NEUTRONS PER FISSION
        SUM OF MT=455 AND MT=456.
  MT=455  NUMBER OF DELAYED NEUTRONS PER FISSION
        SEMI-EMPIRICAL FORMULA BY TUTTLE /2/.
  MT=456  NUMBER OF NEUTRONS PER FISSION
        SEMI-EMPIRICAL FORMULA BY HOWERTON /3/.

MF=2  RESONANCE PARAMETERS
  MT=151  RESONANCE PARAMETERS
     1/V REGION : 1.0E-5 TO 4.15 EV
        NO RESOLVED RESONANCES WERE GIVEN.
     UNRESOLVED RESONANCE REGION : 4.15 EV TO 30 KEV
        OBTAINED FROM OPTICAL MODEL CALCULATION:
           S0=1.08E-4, S1=3.95E-4, S2=1.04E-4, R=8.8 FM.
        ESTIMATED FROM LEVEL DENSITY PARAMETERS AND SYSTEMATICS
           D-OBS=8.3 EV, GAM-G=40 MILLI-EV
        GAM-F OBTAINED BY FITTING THE ESTIMATED FISSION CROSS
        SECTION(SEE BELOW).

     2200 M/S CROSS SECTIONS AND CALCULATED RESONANCE INTEGRALS
                   2200 M/S VALUE           RES. INT.
      TOTAL           13.22  B                 -
      ELASTIC         10.80  B                 -
      FISSION         0.820  B               139  B
      CAPTURE         1.600  B               215  B

MF=3  NEUTRON CROSS SECTIONS
     BELOW 4.15 EV, POINTWISE CROSS SECTIONS WERE GIVEN AS
     FOLLOWS:
       MT=1(TOTAL)       : SUM OF PARTIAL CROSS SECTIONS,
       MT=2(ELASTIC SCAT.): 10.8 B CALCULATED WITH OPTICAL MODEL,
       MT=18(FISSION)    : 1/V SHAPE(0.82 B AT 0.0253 EV ESTIMATED
                      FROM RATIO OF FISSION AND CAPTURE CROSS
                      SECTIONS IN UNRESOLVED RESONANCE REGION),
       MT=102(CAPTURE)    : 1/V SHAPE (1.6 B AT 0.0253 EV
                      OBTAINED FROM MEASUREMENTS BY DIAMOND/4/)
     BETWEEN 4.15 EV AND 30 KEV, CROSS SECTIONS WERE REPRESENTED
     WITH RESONANCE PARAMETERS.

  MT=1,2,4,51-57,91,102,251   TOTAL, ELASTIC AND INELASTIC
     SCATTERING, CAPTURE CROSS SECTIONS AND MU-L
        CALCULATED WITH OPTICAL AND STATISTICAL MODEL CODE
        CASTHY/5/.
        THE SPHERICAL OPTICAL POTENTIAL PARAMETERS (MEV,FM):
           V  =43.4-0.107*EN,              R  =1.282, A  =0.60
           WS =6.95-0.339*EN+0.0531*EN**2, RS =1.29,  B  =0.50
                (DERIVATIVE WOODS-SAXON FORM)
           VSO=7.0,                        RSO=1.282, ASO=0.60
        THIS SET OF POTENTIAL PARAMETERS WAS DETERMINED /6/ TO
        REPRODUCE WELL THE TOTAL CROSS SECTION OF AM-241 BY
        PHILLIPS AND HOWE /7/.

        IN THE STATISTICAL MODEL CALCULATION, COMPETING PROCESSES
        OF FISSION, (N,2N), (N,3N) AND (N,4N), AND LEVEL
        FLUCTUATION WERE CONSIDERED.  THE LEVEL SCHEME OF CM-249
        WAS TAKEN FROM REF./8/.
                   NO.        ENERGY(KEV)   SPIN-PARITY
                  G.S.             0            1/2 +
                   1              26.22         3/2 +
                   2              42.4          5/2 +
                   3              52.18         7/2 +
                   4             110            9/2 +
                   5             110.1          7/2 +
                   6             146            9/2 +
                   7             208            3/2 +
               CONTINUUM LEVELS ASSUMED ABOVE 220 KEV.
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        THE LEVEL DENSITY PARAMETERS : GILBERT AND CAMERON /9/.
        GAMMA-RAY STRENGTH FUNCTION OF 4.8E-4 DEDUCED FROM
        UNRESOLVED RESONANCE PARAMETERS.

  MT=16,17,37  (N,2N), (N,3N) AND (N,4N) REACTION CROSS SECTIONS
        CALCULATED WITH EVAPORATION MODEL/10/.

  MT=18   FISSION
        ESTIMATED AS 0.95 * SIG-F(CM-247) BY USING SYSTEMATICS OF
        BEHRENS AND HOWERTON /11/.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,51-57            CALCULATED WITH OPTICAL MODEL.
  MT=16,17,18,37,91     ISOTROPIC IN THE LABORATORY SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,37,91        EVAPORATION SPECTRUM.
  MT=18                 MAXWELLIAN FISSION SPECTRUM.
                        TEMPERATURE ESTIMATED FROM SYSTEMATICS OF
                        SMITH ET AL./12/.
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MAT number = 9655
 96-CM-250 TIT          EVAL-AUG87 N.TAKAGI
                        DIST-SEP89 REV2-JUN94
HISTORY
87-08 NEW EVALUATION WAS MADE BY N. TAKAGI (TOKYO INSTITUTE OF
      TECHNOLOGY, TIT) /1/.
89-08 CROSS SECTIONS WERE MODIFIED BELOW 90 EV.
94-06 JENDL-3.2.
       NU-P, NU-D AND NU-TOTAL WERE MODIFIED.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (1,452), (1,455), (1,456)
     ***********************************************************


MF=1 GENERAL INFORMATION
  MT=451 COMMENT AND DICTIONARY
  MT=452 NUMBER OF NEUTRONS PER FISSION
       SUM OF NU-P NAD NU-D.
  MT=455 DELAYED NEUTRONS PER FISSION
       AVERAGE VALUES OF SYSTEMATICS BY TUTTLE/2/, BENEDETTI ET
       AL./3/ AND WALDO ET AL./4/  DECAY CONSTANTS WERE ASSUMED
       TO BE THE SAME AS THOSE OF CM-245 EVALUATED BY BRADY AND
       ENGLAND/5/.
  MT=456 PROMPT NEUTRONS PER FISSION
       BASED ON SYSTEMATICS BY MANERO AND KONSHIN/6/, AND BY
       HOWERTON/7/.

MF=2  RESONANCE PARAMETERS
  MT=151   RESONANCE PARAMETERS
    NO RESONANCE PARAMETERS WERE GIVEN.

  2200-M/S CROSS SECTIONS AND RESONANCE INTEGRALS
                     2200 M/S VALUE       RES. INT.
        TOTAL           11.20  B            -
        ELASTIC         10.80  B            -
        FISSION          0.002 B           6.86 B
        CAPTURE          0.40  B           8.23 B

MF=3  NEUTRON CROSS SECTIONS
  MT=1  TOTAL CROSS SECTION
        BELOW 90 EV, CALCULATED AS SUM OF MT'S = 2, 18 AND 102.
        ABOVE 90 EV, OPTICAL MODEL CALCULATION WAS MADE WITH
        CASTHY/8/.  THE POTENTIAL PARAMETERS/9/ USED ARE AS
        FOLLOWS,
           V = 43.4 - 0.107*EN                       (MEV)
           WS= 6.95 - 0.339*EN + 0.0531*EN**2        (MEV)
           WV= 0               , VSO = 7.0           (MEV)
           R = RSO = 1.282     , RS = 1.29           (FM)
           A = ASO = 0.60      , B  = 0.5            (FM)

  MT=2  ELASTIC SCATTERING CROSS SECTION
        BELOW 90 EV, THE CONSTANT CROSS SECTION OF 10.8 BARNS WAS
        ASSUMED, WHICH WAS THE SHAPE ELASTIC SCATTERING CROSS
        SECTION CALCULATED WITH OPTICAL MODEL.  ABOVE THIS ENERGY,
        OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT=4,51-52,91  INELASTIC SCATTERING CROSS SECTIONS.
        OPTICAL AND STATISTICAL MODEL CALCULATION WAS MADE WITH
        CASTHY/8/.  THE LEVEL SCHEME WAS TAKEN FROM REF./10/.
                   NO         ENERGY(KEV)   SPIN-PARITY
                  G.S.             0           0 +
                   1              43           2 +
                   2             142           4 +
        LEVELS ABOVE 200 KEV WERE ASSUMED TO BE OVERLAPPING.
        THE LEVEL DENSITY PARAMETERS WERE TAKEN FROM REF./11/.

  MT=16,17,37  (N,2N), (N,3N) AND (N,4N) REACTION CROSS SECTIONS
        CALCULATED WITH EVAPORATION MODEL.

  MT=18  FISSION CROSS SECTION
        THE CROSS SECTION WAS ASSUMED TO BE 0.1 BARN AT 0.0253 EV
        FROM THE SYSTEMATICS OF PRINCE/12/, AND ASSUMED THE FORM
        OF 1/V BELOW 90 EV.  AT ENERGIES ABOVE 90 EV, THE SHAPE OF
        THE CM-248 FISSION CROSS SECTION WAS ADOPTED, AND IT WAS
        NORMALIZED TO THE SYSTEMATICS OF BEHRENS AND HOWERTON/13/.

  MT=102  CAPTURE CROSS SECTION
        THE CROSS SECTION WAS ASSUMED TO BE 20 BARNS AT 0.0253 EV
        FROM THE SYSTEMATICS OF PRINCE/12/ AND THE CORRELATION OF
        THERMAL CROSS SECTIONS WITH NUMBER OF EXCESS NEUTRON.  THE
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        1/V FORM WAS ASSUMED BELOW 90 EV.  ABOVE 90 EV, THE CROSS
        SECTION WAS CALCULATED WITH CASTHY. THE GAMMA-RAY STRENGTH
        FUNCTION WAS ESTIMATED FROM GAMMA-GAMMA = 0.040 EV AND
        LEVEL SPACING = 180 EV.

  MT=251  MU-L
        CALCULATED WITH CASTHY.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,51-52,91        CALCULATED WITH OPTICAL MODEL.
  MT=16,17,18,37       ISOTROPIC IN THE LAB SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,37,91       EVAPORATION SPECTRA
         OBTAINED FROM LEVEL DENSITY PARAMETERS.

  MT=18                MAXWELLIAN FISSION SPECTRUM.
        TEMPERATURE WAS ESTIMATED FROM Z**2/A DEPENDENCE/14/.
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MAT number = 9752

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 97-BK-249 JAERI       EVAL-MAR85 Y.KIKUCHI AND T.NAKAGAWA
JAERI-M 85-138         DIST-SEP89
HISTORY
85-03 NEW EVALUATION FOR JENDL-3 WAS MADE BY Y.KIKUCHI AND
      T.NAKAGAWA (JAERI).  DETAILS ARE GIVEN IN REF. /1/.
88-02 DATA WERE CHECKED AND COPIED INTO JENDL-3.

MF=1  GENERAL INFORMATION
  MT=451   COMMENTS AND DICTIONARY
  MT=452   NUMBER OF NEUTRONS PER FISSION
             SUM OF MT'S =455 AND 456.
  MT=455   DELAYED NEUTRON DATA
             SEMI-EMPIRICAL FORMULA BY TUTTLE /2/.
  MT=456   DELAYED NEUTRON DATA
             SEMI-EMPIRICAL FORMULA BY HOWERTON /3/.

MF=2,MT=151  RESONANCE PARAMETERS
  RESOLVED RESONANCES FOR MLBW FORMULA : 1.0E-5 EV TO 60 EV
    RESONANCE ENERGIES, NEUTRON AND RADIATIVE WIDTHS WERE TAKEN
    FROM THE EXPERIMENTAL DATA OF BENJAMIN+ /4/.  FOR RESONANCES
    WHOSE RADIATIVE WIDTH WAS UNKNOWN, THE AVERAGE VALUE OF 0.0357
    EV /4/ WAS ADOPTED.  FISSION WIDTH OF 0.0002 EV WAS ESTIMATED
    FROM THE THERMAL FISSION CROSS SECTION, WHICH WAS ESTIMATED
    FROM THE SYSTEMATICS OF CAPTURE TO FISSION RATIO BY PRINCE/5/.
    THE PARAMETERS OF THE NEGATIVE RESONANCE WERE ADJUSTED SO AS
    TO REPRODUCE THE THERMAL CROSS SECTIONS. NO BACKGROUND
    CORRECTION WAS APPLIED.

  UNRESOLVED RESONANCES : 60 EV - 30 KEV
    OBTAINED FROM OPTICAL MODEL CALCULATION:
        S1=3.0E-4  ,S2=0.83E-4  ,R=9.07 FM.
    ESTIMATED FROM RESOLVED RESONANCES:
        DOBS=1.16 EV, GAM-G=35.7 MILLI-EV ,S0=1.13E-4
        GAM-F=0.2 MILLI-EV.

  CALCULATED 2200 M/S CROSS SECTIONS AND RESONANCE INTEGRALS
                    2200 M/S VALUE           RES. INT.
      TOTAL          717.5    B                 -
      ELASTIC          3.93   B                 -
      FISSION          3.96   B               12.1 B
      CAPTURE        709.6    B             1130   B

MF=3  NEUTRON CROSS SECTIONS
  MT=1,2,4,51-68,91,102,251   SIG-T,SIG-EL,SIG-IN,SIG-C,MU-BAR
        CALCULATED WITH OPTICAL AND STATISTICAL MODELS.
        OPTICAL POTENTIAL PARAMETERS WERE OBTAINED BY FITTING THE
        TOTAL CROSS SECTION OF PHILLIPS AND HOWE /6/ FOR AM-241:
           V = 43.4 - 0.107*EN                       (MEV)
           WS= 6.95 - 0.339*EN + 0.0531*EN**2        (MEV)
           WV= 0               , VSO = 7.0           (MEV)
           R = RSO = 1.282     , RS = 1.29           (FM)
           A = ASO = 0.60      , B  = 0.5            (FM)
        STATISTICAL MODEL CALCULATION WITH CASTHY CODE /7/.
           COMPETING PROCESSES : FISSION,(N,2N),(N,3N),(N,4N).
           LEVEL FLUCTUATION CONSIDERED.
        THE LEVEL SCHEME TAKEN FROM REF. /8/.
                    NO.         ENERGY(KEV)    SPIN-PARITY
                  G.S.               0            7/2 +
                     1               8.8          3/2 -
                     2              39.6          5/2 -
                     3              41.8          9/2 +
                     4              82.6          7/2 -
                     5              93.74        11/2 +
                     6             137.7          9/2 -
                     7             155.84        13/2 +
                     8             204.6         11/2 -
                     9             229.3         15/2 +
                    10             283.0         13/2 -
                    11             313.0         17/2 +
                    12             372.8         15/2 -
                    13             377.6          1/2 +
                    14             389.2          5/2 +
                    15             410.6          3/2 +
                    16             421.3          5/2 +
                    17             428.9          7/2 +
                    18             474.9          9/2 +
                CONTINUUM LEVELS ASSUMED ABOVE  519 KEV.
        THE LEVEL DENSITY PARAMETERS : GILBERT AND CAMERON /9/.
        GAMMA-RAY STRENGTH FUNCTION OF 3.2E-2 DEDUCED FROM
        RESONANCE PARAMETERS.
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  MT=16,17,37        (N,2N),(N,3N),(N,4N)
        CALCULATED WITH EVAPORATION MODEL.

  MT=18              FISSION
        EVALUATED ON THE BASIS OF THE MEASURED DATA BY
        SILBERT/10/, VOROTONIKOV+/11/ AND FOMUSHKIN+ /12/.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,51-68            CALCULATED WITH OPTICAL MODEL.
  MT=16,17,18,37,91     ISOTROPIC IN THE LABORATORY SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,37,91        EVAPORATION SPECTRUM.
  MT=18                 MAXWELLIAN FISSION SPECTRUM.
                        TEMPERATURE ESTIMATED FROM SYSTEMATICS OF
                        SMITH+/13/.
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MAT number = 9755

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 97-BK-250 JAERI       EVAL-MAR87 T.NAKAGAWA
 JAERI-M 88-004        DIST-SEP89
HISTORY
87-03 NEW EVALUATION WAS MADE BY T.NAKAGAWA (JAERI).
      DETAILS ARE DESCRIBED IN REF. /1/.

MF=1  GENERAL INFORMATION
  MT=451   COMMENTS AND DICTIONARY
  MT=452   NUMBER OF NEUTRONS PER FISSION
             SUM OF MT=455 AND MT=456
  MT=455   DELAYED NEUTRON DATA
             BASED ON SEMI-EMPIRICAL FORMULA BY TUTTLE /2/.
  MT=456   NUMBER OF PROMPT NEUTRONS PER FISSION
             BASED ON SEMI-EMPIRICAL FORMULA BY HOWERTON /3/.

MF=2,MT=151  RESONANCE PARAMETERS
  RESOLVED RESONANCE PARAMETERS (MLBW) : 1.0E-5 EV TO 100 EV
    RESONANCE PARAMETERS WERE HYPOTHETICALLY GENERATED ADOPTING
    THE FOLLOWING AVERAGE VALUES.
        D-OBS = 2.09 EV (FROM LEVEL DENSITY PARAMETERS )
        S0, S1= 0.83E-4, 3.37E-4 (FROM OPTICAL MODEL CALC.)
        RADIATIVE WIDTH = 0.035EV (SAME AS CF-252)
        FISSION WIDTH = 0.095 EV (ASSUMED THAT THE RATIO OF
                  FISSION TO RADIATIVE WIDTH IS EQUAL TO
                  CROSS SECTION RATIO)
    THE ENERGY OF FIRST LEVEL WAS ADJUSTED TO REPRODUCE THE
    2200-M/S CROSS SECTIONS OF 350 BARNS /4/ AND 960 BARNS /5/ FOR
    CAPTURE AND FISSION, RESPECTIVELY.
  UNRESOLVED RESONANCES                : 0.1 TO 30 KEV
    BY ADOPTING PARAMETERS USED FOR RESOLVED RESONANCE GENERATION
    AS INITIAL VALUES, THEY WERE ADJUSTED TO REPRODUCE THE
    EVALUATED FISSION AND CAPTURE CROSS SECTIONS BY USING ASREP
    /6/.  FINAL VALUES OF THE PARAMETERS ARE,
         S0 = 0.82E-4, S1 = 3.9E-4, D-OBS = 2.09 EV,
         RADIATIVE WIDTH = 0.035 EV, R =9.02 FM,
         FISSION WIDTH = 0.104 EV AT 100 EV, 0.208 EV AT 30 KEV.

  CALCULATED 2200 M/S CROSS SECTIONS AND RESONANCE INTEGRALS
                 2200 M/S VALUE           RES. INT.
      TOTAL        1325.0   B                -
      ELASTIC        12.22  B                -
      FISSION       959.3   B              517.  B
      CAPTURE       353.4   B              199.  B

MF=3  NEUTRON CROSS SECTIONS

 1) THE OPTICAL MODEL CALCULATION WAS PERFORMED WITH CODE CASTHY
    /7/.  OPTICAL POTENTIAL PARAMETERS USED WERE OBTAINED /8/ BY
    FITTING THE TOTAL CROSS SECTION MEASURED BY PHILLIPS AND HOWE
    /9/ FOR AM-241:
           V = 43.4 - 0.107*EN                     (MEV)
           WS= 6.95 - 0.339*EN + 0.0531*EN**2      (MEV)
                   (IN THE DERIVATIVE WOODS-SAXON FORM)
           WV= 0              , VSO = 7.0          (MEV)
           R = RSO = 1.282    ; RS = 1.29          (FM)
           A = ASO = 0.60     , B  = 0.5           (FM)
 2) IN THE STATISTICAL CALCULATION, THE FISSION, (N,2N), (N,3N)
    AND (N,4N) CROSS SECTIONS WERE CONSIDERED AS THE COMPETING
    PROCCESS CROSS SECTIONS.
 3) THE LEVEL DENSITY PARAMETERS WERE DERIVED FROM RESONANCE
    LEVEL SPACINGS AND LOW LAYING EXCITED LEVELS ON THE BASIS OF
    GILBERT-CAMERON'S FORMULA /10/.
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ISOTOPE	247	248	249	250	251
A(1/MEV)	28.1	27.8	34.2	30.05	30.0
SPIN-CUTOFF FACT	30.47	30.39	33.79	31.76	31.82
PAIRING E(MEV)	0.39	0.0	0.903	0.0	0.865
TEMP.(MEV)	0.364	0.326	0.366	0.340	0.385
C(1/MEV)	2.90	10.8	12.2	24.6	6.56
EX(MEV)	7.97	1.85	4.30	2.34	4.05

```
    BELOW 30 KEV, CROSS SECTIONS ARE REPRESENTED WITH RESONANCE
    PARAMETERS.

  MT=1,2  TOTAL AND ELASTIC SCATTERING
    THE OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT=4, 51 TO 59 AND 91 INELASTIC SCATTERING
    THE LEVEL SCHEME WAS TAKEN FROM REF. /11/.
```

NO.	ENERGY(KEV)	SPIN-PARITY
GROUND	0.0	2 -
1	34.5	3 -
2	35.6	4 +
3	78.1	5 +
4	86.4	7 +
5	97.0	5 -
6	104.1	1 -
7	125.4	2 -
8	129.0	6 +
9	131.9	3 +
10	157.0	8 +
11	167.0	6 -
12	175.4	1 +
13	191.0	7 +
14	211.8	2 +
15	237.0	3 +
16	242.0	9 +
17	248.0	7 -
18	270.0	4 +

LEVELS ABOVE 296 KEV WERE ASSUMED TO BE OVERLAPPING.

MT=16, 17 AND 37 (N,2N), (N,3N) AND (N,4N)
CALCULATED WITH EVAPORATION MODEL BY TAKING THE COMPOUND NUCLEUS FORMATION CROSS SECTION CALCULATED WITH OPTICAL MODEL.

MT=18 FISSION
SHAPE OF THE CF-251 FISSION CROSS SECTION /12/ WAS ADOPTED AND MULTIPLIED BY THE FACTOR OF 0.84.

MT=102 RADIATIVE CAPTURE
CALCULATED WITH CASTHY. THE AVERAGE RADIATIVE WIDTH OF 0.035 EV AND S-WAVE LEVEL SPACING OF 2.09 EV WERE ASSUMED.

MT=251 MU-BAR
CALCULATED WITH CASTHY.

MF=4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=2,51-59 CALCULATED WITH OPTICAL MODEL.
MT=16,17,18,37,91 ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF=5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=16,17,37,91 EVAPORATION SPECTRUM ASSUMED.
MT=18 MAXWELLIAN FISSION SPECTRUM.
TEMPERATURE ESTIMATED FROM SYSTEMATICS OF SMITH ET AL./13/.

REFERENCES

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3) HOWERTON, R.J.: NUCL. SCI. ENG., 62, 438 (1977).
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10) GILBERT A. AND CAMERON A.G.W. : CAN. J. PHYS., 43, 1446(1965).
11) SCHMORAK, M.R.: NUCL. DATA SHEETS, 32, 87 (1981).
12) NAKAGAWA, T: JAERI-M 86-086 (1986).
13) SMITH, A.B. ET AL.: ANL/NDM-50 (1979).

MAT number = 9852

```
 98-CF-249 JAERI      EVAL-MAR85 Y.KIKUCHI AND T.NAKAGAWA
 JAERI-M 85-138       DIST-SEP89
HISTORY
85-03 NEW EVALUATION FOR JENDL-3 WAS MADE BY Y.KIKUCHI AND
      T.NAKAGAWA (JAERI).  DETAILS ARE GIVEN IN REF. /1/.
88-02 DATA WERE CHECKED AND ADOPTED FOR JENDL-3.

MF=1  GENERAL INFORMATION
  MT=451   COMMENTS AND DICTIONARY
  MT=452   NUMBER OF NEUTRONS PER FISSION
             SUM OF MT'S = 455 AND 456.
  MT=455   DELAYED NEUTRON DATA
             SEMI-EMPIRICAL FORMULA BY TUTTLE /1/.
  MT=456   NUMBER OF PROMPT NEUTRONS PER FISSION
             SEMI-EMPIRICAL FORMULA BY HOWERTON /3/.

MF=2,MT=151  RESONANCE PARAMETERS
  RESOLVED RESONANCES FOR MLBW FORMULA : 1.0E-5 EV TO 70 EV
    RESONANCE ENERGIES, NEUTRON AND FISSION WIDTHS WERE TAKEN
    FROM THE EXPERIMENTAL DATA OF BENJAMIN+ /4/.  THE RADIATIVE
    WIDTH WAS ASSUMED TO BE 0.04 EV ACCORDING TO DABBS+ /5/.
    A NEGATIVE RESONANCE WAS ADDED SO AS TO REPRODUCE THE THERMAL
    CROSS SECTIONS. NO BACKGROUND CORRECTION WAS APPLIED.

  UNRESOLVED RESONANCES : 70 EV - 30 KEV
    OBTAINED FROM OPTICAL MODEL CALCULATION:
        S1=3.15E-4, S2=0.83E-4, R=9.08 FM.
    ESTIMATED FROM RESOLVED RESONANCES:
        DOBS=1.16 EV, GAM-G=40 MILLI-EV ,S0=1.06E-4
    FISSION WIDTHS WERE ESTIMATED FROM THE CHANNEL THEORY OF
    FISSION /6/. S0, S1 AND S2 VALUES WERE ADJUSTED SO AS TO
    REPRODUCE THE FISSION CROSS SECTION MEASURED BY DABBS+ /5/.

  CALCULATED 2200 M/S CROSS SECTIONS AND RESONANCE INTEGRALS
                  2200 M/S VALUE           RES. INT.
      TOTAL       2176.7    B                 -
      ELASTIC        6.22   B                 -
      FISSION     1666      B               2220  B
      CAPTURE      504.5    B                695  B

MF=3  NEUTRON CROSS SECTIONS
  MT=1,2,4,51-63,91,102,251   SIG-T,SIG-EL,SIG-IN,SIG-C,MU-BAR
        CALCULATED WITH OPTICAL AND STATISTICAL MODELS.
        OPTICAL POTENTIAL PARAMETERS WERE OBTAINED BY FITTING THE
        TOTAL CROSS SECTION OF PHILLIPS AND HOWE /7/ FOR AM-241:
           V = 43.4 - 0.107*EN                      (MEV)
           WS= 6.95 - 0.339*EN + 0.0531*EN**2       (MEV)
           WV= 0              , VSO = 7.0           (MEV)
           R = RSO = 1.282    , RS = 1.29           (FM)
           A = ASO = 0.60     , B  = 0.5            (FM)
        STATISTICAL MODEL CALCULATION WITH CASTHY CODE /8/.
           COMPETING PROCESSES : FISSION,(N,2N),(N,3N),(N,4N).
           LEVEL FLUCTUATION CONSIDERED.
        THE LEVEL SCHEME TAKEN FROM REF. /9/.
                  NO.        ENERGY(KEV)   SPIN-PARITY
                 G.S.            0            9/2 -
                   1            62.47        11/2 -
                   2           136.2         13/2 -
                   3           145.0          5/2 +
                   4           188.0          7/2 +
                   5           219.0         15/2 -
                   6           243.1          9/2 +
                   7           379.5          7/2 +
                   8           416.6          1/2 +
                   9           437.5          9/2 +
                  10           440.0          3/2 +
                  11           443.0          7/2 +
                  12           460.0          5/2 +
                  13           500.6          9/2 +
               CONTINUUM LEVELS ASSUMED ABOVE  550 KEV.
        THE LEVEL DENSITY PARAMETERS : GILBERT AND CAMERON /10/.
        GAMMA-RAY STRENGTH FUNCTION OF 3.3E-2 DEDUCED FROM
        RESONANCE PARAMETERS.

  MT=16,17,37       (N,2N),(N,3N),(N,4N)
        CALCULATED WITH EVAPORATION MODEL.

  MT=18             FISSION
        EVALUATED ON THE BASIS OF THE MEASURED DATA BY
        SILBERT/11/, DABBS+ /5/ AND KUPRIYANOV+ /12/.
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MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,51-63            CALCULATED WITH OPTICAL MODEL.
  MT=16,17,18,37,91     ISOTROPIC IN THE LABORATORY SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,37,91        EVAPORATION SPECTRUM.
  MT=18                 MAXWELLIAN FISSION SPECTRUM.
                        TEMPERATURE ESTIMATED FROM SYSTEMATICS OF
                        SMITH+/13/.
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REFERENCES
 1) KIKUCHI Y. AND NAKAGAWA T.: JAERI-M 85-138 (1985).
 2) TUTTLE R.J.: INDC(NDS)-107/G+SPECIAL, P.29 (1979).
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11) SILBERT M.G.: NUCL. SCI. ENG., 51, 376 (1973).
12) KUPRIYANOV V.M. ET AL.: SOV. ATOM. ENERGY, 55, 472 (1984).
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MAT number = 9855

```
 98-CF-250 JAERI        EVAL-MAR86 T.NAKAGAWA
 JAERI-M 86-086         DIST-SEP89
HISTORY
86-03 NEW EVALUATION WAS MADE BY T.NAKAGAWA (JAERI).
      DETAILS ARE DESCRIBED IN REF. /1/.

MF=1  GENERAL INFORMATION
  MT=451   COMMENTS AND DICTIONARY
  MT=452   NUMBER OF NEUTRONS PER FISSION
             SUM OF MT=455 AND MT=456
  MT=455   DELAYED NEUTRON DATA
             BASED ON SEMI-EMPIRICAL FORMULA BY TUTTLE /2/.
  MT=456   NUMBER OF PROMPT NEUTRONS PER FISSION
             BASED ON SEMI-EMPIRICAL FORMULA BY HOWERTON /3/.

MF=2,MT=151  RESONANCE PARAMETERS
  RESOLVED RESONANCES FOR SLBW FORMULA : 1.0E-5 EV TO 150 EV
    HYPOTHETICAL RESONANCE LEVELS WERE GENERATED, AND THEIR
    PARAMETERS WERE DETERMINED FROM THE ASSUMED AVERAGE PARAMETERS
        D-0 = 16 EV,  RADIATIVE CAPTURE WIDTH = 0.0369 EV,
        S-0 = 1.0E-4, FISSION WITH = 0.0001 EV, R = 9.252 FM.
    PARAMETERS OF THE NEGATIVE AND FIRST POSITIVE LEVELS WERE
    ADJUSTED SO AS TO REPRODUCE THE THERMAL CROSS SECTIONS AND
    RESONANCE INTEGRALS.
  UNRESOLVED RESONANCES                  : 150 EV TO 30 KEV
    S-0 = 1.0E-4, S-1 = 3.3E-4, D-0=16 EV, R = 9.11 FM,
    RADIATIVE WIDTH = 0.0369 EV, FISSION WIDTH = 0.0001 EV.
    THE SCATTERING RADIUS WAS ADJUSTED SLIGHTLY.

  CALCULATED 2200 M/S CROSS SECTIONS AND RESONANCE INTEGRALS
```

	2200 M/S VALUE	RES. INT.
TOTAL	1950.7 B	-
ELASTIC	167.4 B	-
FISSION	4.09 B	27.8 B
CAPTURE	1779.2 B	8420 B

```
MF=3  NEUTRON CROSS SECTIONS
  MT=1    TOTAL
  MT=2    ELASTIC SCATTERING
  MT=4, 51 TO 79 AND 91 INELASTIC SCATTERING
  MT=102 RADIATIVE CAPTURE
  MT=251 MU-BAR
    CALCULATED WITH THE PROGRAM CASTHY /4/ BASED ON THE OPTICAL
    AND STATISTICAL MODELS.  OPTICAL POTENTIAL PARAMETERS WERE
    OBTAINED /5/ BY FITTING THE TOTAL CROSS SECTION OF PHILLIPS
    AND HOWE /6/ FOR AM-241:
           V = 43.4 - 0.107*EN                       (MEV)
           WS= 6.95 - 0.339*EN + 0.0531*EN**2        (MEV)
           WV= 0             , VSO = 7.0             (MEV)
           R = RSO = 1.282   , RS = 1.29             (FM)
           A = ASO = 0.60    , B  = 0.5              (FM)
    IN THE STATISTICAL CALCULATION, LEVEL FLUCTUATION AND
    COMPETING PROCESS (FISSION, (N,2N) AND (N,3N)) WERE TAKEN INTO
    ACCOUNT.  THE LEVEL SCHEME WAS TAKEN FROM REF. /7/.
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NO.	ENERGY(KEV)	J-PARITY	NO.	ENERGY(KEV)	J-PARITY
GROUND	0.0	0 +	15	1209.98	2 -
1	42.722	2 +	16	1211.	3 -
2	141.886	4 +	17	1244.51	2 +
3	296.25	6 +	18	1255.47	4 -
4	871.64	2 -	19	1266.65	0 +
5	905.90	3 -	20	1296.64	2 +
6	952.07	4 -	21	1311.07	5 -
7	1008.6	5 -	22	1335.	3 -
8	1031.85	2 +	23	1377.83	6 -
9	1070.	6 -	24	1385.49	(1 +)
10	1071.38	3 +	25	1396.16	5 -
11	1123.	4 +	26	1411.34	(1 +)
12	1154.23	0 +	27	1426.86	3 -
13	1175.52	1 -	28	1457.83	6 -
14	1189.40	2 +	29	1478.45	5 -

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         LEVELS ABOVE 1.50 MEV WERE ASSUMED TO BE OVERLAPPING.
    THE LEVEL DENSITY PARAMETERS WERE DERIVED FROM RESONANCE LEVEL
    SPACINGS AND LOW LAYING EXCITED LEVELS ON THE BASIS OF
    GILBERT-CAMERON'S FOUMULA /8/.  THE AVERAGE RADIATIVE CAPTURE
    WIDTH OF 0.0369 EV AND S-WAVE LEVEL SPACING OF 16 EV WERE
    ASSUMED.

  MT=16 AND 17  (N,2N) AND (N,3N)
    CALCULATED WITH EVAPORATION MODEL.
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  MT=18    FISSION
    EVALUATED ON THE BASIS OF THE SYSTEMATICS.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,51-79          CALCULATED WITH OPTICAL MODEL.
  MT=16,17,18,91      ISOTROPIC DISTRIBUTIONS IN THE LABORATORY
      SYSTEM WERE ASSUMED.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,91         EVAPORATION SPECTRUM.
  MT=18               MAXWELLIAN FISSION SPECTRUM.
                         TEMPERATURE ESTIMATED FROM SYSTEMATICS OF
                         SMITH ET AL./9/.
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REFERENCES
 1) NAKAGAWA, T.: JAERI-M 86-086 (1986).
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 3) HOWERTON, R.J.: NUCL. SCI. ENG., 62, 438 (1977).
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 5) IGARASI, S. AND NAKASAWA, T.: JAERI-M 8342 (1979).
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MAT number = 9858

```
 98-CF-251 JAERI       EVAL-MAR86 T.NAKAGAWA
 JAERI-M 86-086        DIST-SEP89
HISTORY
86-03 NEW EVALUATION WAS MADE BY T.NAKAGAWA (JAERI).
      DETAILS ARE DESCRIBED IN REF. /1/.

MF=1  GENERAL INFORMATION
  MT=451   COMMENTS AND DICTIONARY
  MT=452   NUMBER OF NEUTRONS PER FISSION
             SUM OF MT=455 AND MT=456
  MT=455   DELAYED NEUTRON DATA
             BASED ON SEMI-EMPIRICAL FORMULA BY TUTTLE /2/.
  MT=456   NUMBER OF PROMPT NEUTRONS PER FISSION
             BASED ON SEMI-EMPIRICAL FORMULA BY HOWERTON /3/.

MF=2,MT=151  RESONANCE PARAMETERS
  RESOLVED RESONANCES FOR SLBW FORMULA : 1.0E-5 EV TO 150 EV
    HYPOTHETICAL RESONANCE LEVELS WERE GENERATED, AND THEIR
    PARAMETERS WERE DETERMINED FROM THE ASSUMED AVERAGE PARAMETERS
        D-0 = 6.3 EV, RADIATIVE CAPTURE WIDTH = 0.0435 EV,
        S-0 = 1.0E-4, FISSION WITH = 0.0746 EV, R = 9.253 FM.
    PARAMETERS OF THE NEGATIVE AND FIRST POSITIVE LEVELS WERE
    ADJUSTED SO AS TO REPRODUCE THE THERMAL CROSS SECTIONS AND
    RESONANCE INTEGRALS.
  UNRESOLVED RESONANCES                  : 150 EV TO 30 KEV
    PARAMETERS WERE ADJUSTED SO AS TO REPRODUCE THE ASSUMED
    FISSION AND RADIATIVE CAPTURE CROSS SECTIONS.
        S-0 = 0.843E-4, S-1 = 4.56E-4, R = 8.842 FM,
        D-0 = 6.3 EV, RADIATIVE WIDTH = 0.0435 EV,
        FISSION WIDTH = 0.281 EV (FOR L=0), = 0.551 EV (FOR L=1)

  CALCULATED 2200 M/S CROSS SECTIONS AND RESONANCE INTEGRALS
                  2200-M/S VALUE          RES. INT.
      TOTAL       7889.4    B                 -
      ELASTIC       76.04   B                 -
      FISSION     4935.4    B              2780.  B
      CAPTURE     2877.9    B              1600.  B

MF=3  NEUTRON CROSS SECTIONS
  MT=1   TOTAL
  MT=2   ELASTIC SCATTERING
  MT=4, 51 TO 73 AND 91 INELASTIC SCATTERING
  MT=102 RADIATIVE CAPTURE
  MT=251 MU-BAR
    CALCULATED WITH THE PROGRAM CASTHY /4/ BASED ON THE OPTICAL
    AND STATISTICAL MODELS.  OPTICAL POTENTIAL PARAMETERS WERE
    OBTAINED /5/ BY FITTING THE TOTAL CROSS SECTION OF PHILLIPS
    AND HOWE /6/ FOR AM-241:
           V = 43.4 - 0.107*EN                    (MEV)
           WS= 6.95 - 0.339*EN + 0.0531*EN**2     (MEV)
           WV= 0              , VSO = 7.0         (MEV)
           R = RSO = 1.282    , RS = 1.29         (FM)
           A = ASO = 0.60     , B  = 0.5          (FM)
    IN THE STATISTICAL CALCULATION, LEVEL FLUCTUATION AND
    COMPETING PROCESS(FISSION, (N,2N), (N,3N) AND (N,4N)) WERE
    TAKEN INTO ACCOUNT.  THE LEVEL SCHEME WAS TAKEN FROM REF. /7/.
          NO.  ENERGY(KEV) J-PARITY     NO.  ENERGY(KEV) J-PARITY
         -------------------------   -------------------------
         GROUND    0.0      1/2 +       12     295.7     13/2 +
            1     24.825    3/2 +       13     319.29     9/2 +
            2     47.828    5/2 +       14     325.35    13/2 +
            3    105.73     7/2 +       15     370.39    11/2 -
            4    106.304    7/2 +       16     392.0     11/2 +
            5    146.46     9/2 +       17     424.10    15/2 +
            6    166.31     9/2 +       18     434.3      9/2 -
            7    177.69     3/2 +       19     442.      13/2 -
            8    211.72     5/2 +       20     514.      11/2 -
            9    237.76    11/2 +       21     544.05     5/2 +
           10    239.34    11/2 +       22     590.18     7/2 +
           11    258.44     7/2 +       23     649.2      9/2 +
         -------------------------   -------------------------
           LEVELS ABOVE 700 KEV WERE ASSUMED TO BE OVERLAPPING.
    THE LEVEL DENSITY PARAMETERS WERE DERIVED FROM RESONANCE LEVEL
    SPACINGS AND LOW LAYING EXCITED LEVELS ON THE BASIS OF
    GILBERT-CAMERON'S FOUMULA /8/.  THE AVERAGE RADIATIVE CAPTURE
    WIDTH OF 0.0435 EV AND S-WAVE LEVEL SPACING OF 6.3 EV WERE
    ASSUMED.

  MT=16,17 AND 37  (N,2N), (N,3N) AND (N,4N)
    CALCULATED WITH EVAPORATION MODEL.
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  MT=18    FISSION
    EVALUATED ON THE BASIS OF THE SYSTEMATICS.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,51-73            CALCULATED WITH OPTICAL MODEL.
  MT=16,17,18,37,91     ISOTROPIC DISTRIBUTIONS IN THE LABORATORY
      SYSTEM WERE ASSUMED.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,37,91        EVAPORATION SPECTRUM.
  MT=18                 MAXWELLIAN FISSION SPECTRUM.
                        TEMPERATURE ESTIMATED FROM SYSTEMATICS OF
                        SMITH ET AL./9/.
```

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 1) NAKAGAWA, T.: JAERI-M 86-086 (1986).
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 6) PHILLIPS, T.W. AND HOWE, F.R.: NUCL. SCI. ENG., 69, 375(1979).
 7) SCHMORAK, M.R.: NUCL. DATA SHEETS, 32, 87 (1981).
 8) GILBERT, A. AND CAMERON, A.G.W.: CAN. J. PHYS., 43,1446(1965).
 9) SMITH A.B. ET AL.: ANL/NDM-50 (1979).
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MAT number = 9861

```
 98-CF-252 JAERI      EVAL-MAR87 T.NAKAGAWA
 JAERI-M 88-004       DIST-SEP89
HISTORY
87-03 NEW EVALUATION WAS MADE BY T.NAKAGAWA (JAERI).
      DETAILS ARE DESCRIBED IN REF. /1/.

MF=1  GENERAL INFORMATION
  MT=451   COMMENTS AND DICTIONARY
  MT=452   NUMBER OF NEUTRONS PER FISSION
             SUM OF MT=455 AND MT=456
  MT=455   DELAYED NEUTRON DATA
             BASED ON SEMI-EMPIRICAL FORMULA BY TUTTLE /2/.
  MT=456   NUMBER OF PROMPT NEUTRONS PER FISSION
             BASED ON SEMI-EMPIRICAL FORMULA BY HOWERTON /3/.

MF=2,MT=151  RESONANCE PARAMETERS
  RESOLVED RESONANCE PARAMETERS (MLBW) : 1.0E-5 EV TO 1 KEV
    RESONANCE PARAMETERS WERE TAKEN FROM MOORE EL AL. /4/ BY
    ASSUMING AN AVERAGE VALUE OF RADIATIVE CAPTURE WIDTH (0.035
    EV) AND FISSION WIDTH (0.035 EV).  TWO HYPOTHETICAL RESONANCES
    AT 1.4 AND -3.5 EV WERE ADOPTED TO REPRODUCE THE 2200-M/S
    CROSS SECTIONS AND RESONANCE INTEGRALS /5,6/.  SCATTERING
    RADIUS OF 9.23 FM WAS ESTIMATED FROM THE SHAPE ELASTIC
    SCATTERING CROSS SECTION CALCULATED WITH CASTHY /7/ FROM
    OPTICAL POTENTIAL PARAMETERS GIVEN BELOW.
  UNRESOLVED RESONANCES                : 1 TO 30 KEV
    PARAMETERS WERE ESTIMATED FROM RESOLVED RESONANCES AND
    ADJUSTED SO AS TO REPRODUCE THE EVALUATED FISSION AND CAPTURE
    CROSS SECTIONS BY USING ASREP /8/.  VALUES OF THE PARAMETERS
    ARE D-OBS = 27 EV, R = 8.9 FM AND S0, S1, CAPT-WIDTH AND FISSION
    WIDTHS ARE AS FOLLOWS.
           ENERGY      S0        S1     CAPT-WIDTH  FISS-WIDTH
            1.0 KEV   1.22-4    3.37-4    0.035 EV    0.056 EV
           30.0       1.22-4    3.37-4    0.035       0.096

  CALCULATED 2200 M/S CROSS SECTIONS AND RESONANCE INTEGRALS
                   2200 M/S VALUE          RES. INT.
      TOTAL          64.77   B                 -
      ELASTIC        11.04   B                 -
      FISSION        33.03   B               111.  B
      CAPTURE        20.71   B                47.4 B

MF=3  NEUTRON CROSS SECTIONS
    BELOW 30 KEV, CROSS SECTIONS ARE REPRESENTED WITH RESONANCE
    PARAMETERS.  ABOVE 30 KEV, DATA WERE MAINLY CALCULATED WITH
    OPTICAL AND STATISTICAL MODELS.

 1) THE OPTICAL MODEL CALCULATION WAS PERFORMED WITH CODE CASTHY
    /7/.  OPTICAL POTENTIAL PARAMETERS USED WERE OBTAINED /9/ BY
    FITTING THE TOTAL CROSS SECTION MEASURED BY PHILLIPS AND HOWE
    /10/ FOR AM-241:
           V = 43.4 - 0.107*EN                         (MEV)
           WS= 6.95 - 0.339*EN + 0.0531*EN**2          (MEV)
                   (IN THE DERIVATIVE WOODS-SAXON FORM)
           WV= 0              , VSO = 7.0              (MEV)
           R = RSO = 1.282    , RS = 1.29              (FM)
           A = ASO = 0.60     , B  = 0.5               (FM)
 2) IN THE STATISTICAL CALCULATION, THE FISSION, (N,2N), (N,3N)
    AND (N,4N) CROSS SECTIONS WERE CONSIDERED AS THE COMPETING
    PROCESS CROSS SECTIONS.
 3) THE LEVEL DENSITY PARAMETERS WERE DERIVED FROM RESONANCE
    LEVEL SPACINGS AND LOW LAYING EXCITED LEVELS ON THE BASIS OF
    GILBERT-CAMERON'S FORMULA /11/.
      -----------------------------------------------------------
              ISOTOPE     249      250      251      252      253
      -----------------------------------------------------------
             A(1/MEV)    29.4     31.2     32.2     31.6     32.2
       SPIN-CUTOFF FACT  31.25    32.36    32.97    32.74    33.14
         PAIRING E(MEV)   1.16     1.673    0.77     1.635    0.77
             TEMP.(MEV)  0.3693   0.4025   0.3809   0.3927   0.3322
              C(1/MEV)   1.625    2.093    14.84    1.895     3.59
              EX(MEV)    3.954    5.418    4.204    5.233    3.226
      -----------------------------------------------------------

  MT=1,2  TOTAL AND ELASTIC SCATTERING
    THE OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT=4, 51 TO 59 AND 91 INELASTIC SCATTERING
    THE LEVEL SCHEME WAS TAKEN FROM REF. /12/.

          NO.     ENERGY(KEV)       SPIN-PARITY
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 --------------------------------------------
   GROUND         0.0            0 +
     1           45.75           2 +
     2          151.73           4 +
     3          804.82           2 +
     4          830.81           2 -
     5          845.72           3 +
     6          867.51           3 -
     7          900.3            4 +
     8          917.03           4 -
     9          969.83           3 +
 --------------------------------------------
  LEVELS ABOVE 1.03 MEV WERE ASSUMED TO BE OVERLAPPING.
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MT=16, 17 AND 37 (N,2N), (N,3N) AND (N,4N)
CALCULATED WITH EVAPORATION MODEL BY TAKING THE COMPOUND NUCLEUS FORMATION CROSS SECTION CALCULATED WITH OPTICAL MODEL.

MT=18 FISSION
EVALUATED ON THE BASIS OF EXPERIMENTAL DATA BY MOORE EL AL. /4/.

MT=102 RADIATIVE CAPTURE
CALCULATED WITH CASTHY. THE AVERAGE RADIATIVE WIDTH OF 0.035 EV AND S-WAVE LEVEL SPACING OF 27 EV WERE ASSUMED.

MT=251 MU-BAR
CALCULATED WITH CASTHY.

MF=4 ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=2,51-59 CALCULATED WITH OPTICAL MODEL.
MT=16,17,18,37,91 ISOTROPIC DISTRIBUTIONS IN THE LABORATORY SYSTEM WERE ASSUMED.

MF=5 ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
MT=16,17,37,91 EVAPORATION SPECTRUM ASSUMED.
MT=18 MAXWELLOAN FISSION SPECTRUM.
TEMPERATURE ESTIMATED FROM SYSTEMATICS OF SMITH ET AL./13/.

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12) SCHMORAK, M.R.: NUCL. DATA SHEETS, 32, 87 (1981).
13) SMITH A.B. ET AL.: ANL/NDM-50 (1979).

MAT number = 9867

```
 98-CF-254 TIT         EVAL-AUG87 N.TAKAGI
                       DIST-SEP89 REV2-JUN94
HISTORY
87-08 NEW EVALUATION WAS MADE BY N. TAKAGI (TOKYO INSTITUTE OF
      TECHNOLOGY, TIT) /1/.
94-06 JENDL-3.2.
       NU-P, NU-D AND NU-TOTAL WERE MODIFIED.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (1,452), (1,455), (1,456)
     ***********************************************************


MF=1  GENERAL INFORMATION
  MT=451   COMMENT AND DICTIONARY
  MT=452   NUMBER OF NEUTRONS PER FISSION
        SUM OF NU-P NAD NU-D.
  MT=455   DELAYED NEUTRONS PER FISSION
        AVERAGE VALUES OF SYSTEMATICS BY TUTTLE/2/, BENEDETTI ET
        AL./3/ AND WALDO ET AL./4/  DECAY CONSTANTS WERE ASSUMED
        TO BE THE SAME AS THOSE OF CF-252 EVALUATED BY BRADY AND
        ENGLAND/5/.
  MT=456   PROMPT NEUTRONS PER FISSION
        CALCULATED FROM THE SEMI-EMPIRICAL FORMULA OF HOWERTON/6/.

MF=2  RESONANCE PARAMETERS
  MT=151   RESONANCE PARAMETERS
    NO RESONANCE PARAMETERS WERE GIVEN.

  2200-M/S CROSS SECTIONS AND RESONANCE INTEGRALS
                       2200 M/S VALUE       RES. INT.
        TOTAL            17.10  B              -
        ELASTIC          10.60  B              -
        FISSION           2.00  B            24.3 B
        CAPTURE           4.50  B             6.5 B

MF=3  NEUTRON CROSS SECTIONS
  MT=1  TOTAL CROSS SECTION
        BELOW 120 EV, CALCULATED AS SUM OF MT'S = 2, 18 AND 102.
        ABOVE 120 EV, OPTICAL MODEL CALCULATION WAS MADE WITH
        CASTHY/7/.  THE POTENTIAL PARAMETERS/8/ USED ARE AS
        FOLLOWS.
           V = 43.4 - 0.107*EN                        (MEV)
           WS= 6.95 - 0.339*EN + 0.0531*EN**2         (MEV)
           WV= 0               , VSO = 7.0            (MEV)
           R = RSO = 1.282     , RS = 1.29            (FM)
           A = ASO = 0.60      , B  = 0.5             (FM)

  MT=2  ELASTIC SCATTERING CROSS SECTION
        BELOW 120 EV, THE CONSTANT CROSS SECTION OF 10.6 BARNS WAS
        ASSUMED, WHICH WAS THE SHAPE ELASTIC SCATTERING CROSS
        SECTION CALCULATED WITH OPTICAL MODEL. ABOVE THIS ENERGY,
        OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT=4,51,91  INELASTIC SCATTERING CROSS SECTIONS.
        OPTICAL AND STATISTICAL MODEL CALCULATION WAS MADE WITH
        CASTHY/7/.  THE LEVEL SCHEME WAS TAKEN FROM REF./9/.
                  NO          ENERGY(KEV)   SPIN-PARITY
                 G.S.              0.0         0 +
                   1              45.0         2 +
        LEVELS ABOVE 140 KEV WERE ASSUMED TO BE OVERLAPPING.
        THE LEVEL DENSITY PARAMETERS WERE TAKEN FROM REF./10/.

  MT=16,17,37  (N,2N), (N,3N) AND (N,4N) REACTION CROSS SECTIONS
        CALCULATED WITH EVAPORATION MODEL.

  MT=18  FISSION CROSS SECTION
        THE THERMAL CROSS SECTION OF 2.0 BARNS WAS ESTIMATED FROM
        THE RATIO OF FISSION AND CAPTURE CROSS SECTIONS AT 1 EV
        AND MEASURED CAPTURE CROSS SECTION AT 0.0253 EV.  THE FORM
        OF 1/V WAS ASSUMED BELOW 120 EV.  FOR ENERGY ABOVE 120 EV,
        THE SHAPE OF CF-252 FISSION CROSS SECTION WAS ADOPTED AND
        IT WAS NORMALIZED TO THE SYSTEMATICS OF BEHRENS AND
        HOWERTON/11/.

  MT=102  CAPTURE CROSS SECTION
        MEASURED THERMAL CROSS SECTION OF 4.5 BARNS WAS TAKEN FROM
        REF./12/, AND 1/V FORM WAS ASSUMED BELOW 120 EV.  ABOVE
        120 EV, THE CROSS SECTION WAS CALCULATED WITH CASTHY.  THE
        GAMMA-RAY STRENGTH FUNCTION WAS ESTIMATED FROM GAMMA-GAMMA
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        = 0.040 EV AND LEVEL SPACING = 240 EV.

  MT=251  MU-L
        CALCULATED WITH CASTHY.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,51,91            CALCULATED WITH OPTICAL MODEL.
  MT=16,17,18,37        ISOTROPIC IN THE LAB SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,37,91        EVAPORATION SPECTRA.
         OBTAINED FROM LEVEL DENSITY PARAMETERS.

  MT=18                 MAXWELLIAN FISSION SPECTRUM.
         TEMPERATURE WAS ESTIMATED FROM Z**2/A DEPENDENCE/13/.
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REFERENCES


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    RESONANCE PARAMETERS AND THERMAL CROSS SECTIONS", PART B,
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MAT number = 9914

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 99-ES-254 TIT          EVAL-AUG87 N.TAKAGI
                        DIST-SEP89 REV2-JUN94
HISTORY
87-08 NEW EVALUATION WAS MADE BY N. TAKAGI (TOKYO INSTITUTE OF
      TECHNOLOGY, TIT) /1/.
94-06 JENDL-3.2.
       NU-P, NU-D AND NU-TOTAL WERE MODIFIED.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (1,452), (1,455), (1,456)
     ***********************************************************


MF=1  GENERAL INFORMATION
  MT=451   COMMENT AND DICTIONARY
  MT=452   NUMBER OF NEUTRONS PER FISSION
        SUM OF NU-P NAD NU-D.
  MT=455   DELAYED NEUTRONS PER FISSION
        AVERAGE VALUES OF SYSTEMATICS BY TUTTLE/2/, BENEDETTI ET
        AL./3/ AND WALDO ET AL./4/  DECAY CONSTANTS WERE EVALUATED
        BY BRADY AND ENGLAND/5/.
  MT=456   PROMPT NEUTRONS PER FISSION
        CALCULATED FROM THE SEMI-EMPIRICAL FORMULA OF HOWERTON/6/.

MF=2  RESONANCE PARAMETERS
  MT=151   RESONANCE PARAMETERS
    NO RESONANCE PARAMETERS WERE GIVEN.

  2200-M/S CROSS SECTIONS AND RESONANCE INTEGRALS
                      2200 M/S VALUE       RES. INT.
        TOTAL          2004.90  B             -
        ELASTIC          10.60  B             -
        FISSION        1966.00  B           1220   B
        CAPTURE          28.30  B             18.0  B

MF=3  NEUTRON CROSS SECTIONS
  MT=1  TOTAL CROSS SECTION
        BELOW 5 EV, CALCULATED AS SUM OF MT'S = 2, 18 AND 102.
        ABOVE 5 EV, OPTICAL MODEL CALCULATION WAS MADE WITH
        CASTHY/7/.  THE POTENTIAL PARAMETERS/8/ USED ARE AS
        FOLLOWS,
           V = 43.4 - 0.107*EN                         (MEV)
           WS= 6.95 - 0.339*EN + 0.0531*EN**2          (MEV)
           WV= 0              , VSO = 7.0              (MEV)
           R = RSO = 1.282    , RS = 1.29              (FM)
           A = ASO = 0.60     , B  = 0.5               (FM)

  MT=2  ELASTIC SCATTERING CROSS SECTION
        BELOW 5 EV, THE CONSTANT CROSS SECTION OF 10.6 BARNS WAS
        ASSUMED, WHICH WAS THE SHAPE ELASTIC SCATTERING CROSS
        SECTION CALCULATED WITH OPTICAL MODEL.  ABOVE THIS ENERGY,
        OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT=4,51-52,91  INELASTIC SCATTERING CROSS SECTIONS.
        OPTICAL AND STATISTICAL MODEL CALCULATION WAS MADE WITH
        CASTHY/7/.  THE LEVEL SCHEME WAS TAKEN FROM REF./9/.
                   NO          ENERGY(KEV)   SPIN-PARITY
                  G.S.              0.0          7 +
                    1              78.0          2 +
        LEVELS ABOVE 503 KEV WERE ASSUMED TO BE OVERLAPPING.
        THE LEVEL DENSITY PARAMETERS WERE TAKEN FROM REF./10/.

  MT=16,17,37  (N,2N), (N,3N) AND (N,4N) REACTION CROSS SECTIONS
        CALCULATED WITH EVAPORATION MODEL.

  MT=18  FISSION CROSS SECTION
        MEASURED THERMAL CROSS SECTION OF 1966 BARNS WAS TAKEN
        FROM REF./11/. THE 1/V FORM WAS ASSUMED BELOW 5 EV. THE
        SHAPE OF CROSS SECTION NEAR 5 EV WAS ADJUSTED SO AS TO
        REPRODUCE THE MEASURED RESONANCE INTEGRAL OF 1200+-250
        BARNS/11/.  ABOVE 5 EV, THE CROSS SECTION SHAPE WAS
        ASSUMED TO BE THE SAME AS BK-250 FISSION CROSS SECTION
        AND IT WAS NORMALIZED TO SYSTEMATICS OF BEHRENS AND
        HOWERTON/12/.

  MT=102  CAPTURE CROSS SECTION
        MEASURED THERMAL CROSS SECTION OF 28.3 BARNS WAS TAKEN
        FROM REF./11/, AND 1/V FORM WAS ASSUMED BELOW 5 EV.  THE
        CROSS SECTION NEAR 5 EV WAS ADJUSTED SO AS TO REPRODUCE
        THE MEASURED RESONANCE INTEGRAL OF 18.2+-1.5 BARNS/11/.
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        ABOVE 5 EV, CALCULATED WITH CASTHY. THE GAMMA-RAY STRENGTH
        FUNCTION WAS ESTIMATED FROM GAMMA-GAMMA = 0.040 EV AND
        LEVEL SPACING = 2 EV.

  MT=251  MU-L
        CALCULATED WITH CASTHY.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,51-52,91       CALCULATED WITH OPTICAL MODEL.
  MT=16,17,18,37      ISOTROPIC IN THE LAB SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,37,91      EVAPORATION SPECTRA
         OBTAINED FROM LEVEL DENSITY PARAMETERS.

  MT=18               MAXWELLIAN FISSION SPECTRUM.
        TEMPERATURE WAS ESTIMATED FROM Z**2/A DEPENDENCE/13/.
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REFERENCES


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MAT number = 9915

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 99-ES-255 TIT         EVAL-AUG87 N.TAKAGI
                       DIST-SEP89 REV2-JUN94
HISTORY
87-08 NEW EVALUATION WAS MADE BY N. TAKAGI (TOKYO INSTITUTE OF
      TECHNOLOGY, TIT) /1/.
94-06 JENDL-3.2.
       NU-P, NU-D AND NU-TOTAL WERE MODIFIED.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (1,452), (1,455), (1,456)
     ***********************************************************


MF=1  GENERAL INFORMATION
  MT=451   COMMENT AND DICTIONARY
  MT=452   NUMBER OF NEUTRONS PER FISSION
        SUM OF NU-P NAD NU-D.
  MT=455   DELAYED NEUTRONS PER FISSION
        AVERAGE VALUES OF SYSTEMATICS BY TUTTLE/2/, BENEDETTI ET
        AL./3/ AND WALDO ET AL./4/  DECAY CONSTANTS WERE ASSUMED
        TO BE THE SAME AS THOSE FOR ES-254 EVALUATED BY BRADY AND
        ENGLAND/5/.
  MT=456   PROMPT NEUTRONS PER FISSION
        CALCULATED FROM THE SEMI-EMPIRICAL FORMULA OF HOWERTON/6/.

MF=2  RESONANCE PARAMETERS
  MT=151   RESONANCE PARAMETERS
    NO RESONANCE PARAMETERS WERE GIVEN.

  2200-M/S CROSS SECTIONS AND RESONANCE INTEGRALS
                       2200 M/S VALUE       RES. INT.
        TOTAL             79.03  B             -
        ELASTIC           10.60  B             -
        FISSION           13.43  B            93.3 B
        CAPTURE           55.00  B           278   B

MF=3  NEUTRON CROSS SECTIONS
  MT=1  TOTAL CROSS SECTION
        BELOW 2.47 EV, CALCULATED AS SUM OF MT'S = 2, 18 AND 102.
        ABOVE 2.47 EV, OPTICAL MODEL CALCULATION WAS MADE WITH
        CASTHY/7/.  THE POTENTIAL PARAMETERS/8/ USED ARE AS
        FOLLOWS.
           V = 43.4 - 0.107*EN                       (MEV)
           WS= 6.95 - 0.339*EN + 0.0531*EN**2        (MEV)
           WV= 0               , VSO = 7.0           (MEV)
           R = RSO = 1.282     , RS = 1.29           (FM)
           A = ASO = 0.60      , B  = 0.5            (FM)

  MT=2  ELASTIC SCATTERING CROSS SECTION
        BELOW 2.47 EV, THE CONSTANT CROSS SECTION OF 10.6 BARNS
        WAS ASSUMED, WHICH WAS THE SHAPE ELASTIC SCATTERING CROSS
        SECTION CALCULATED WITH OPTICAL MODEL. ABOVE THIS ENERGY,
        OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT=4,51-53,91  INELASTIC SCATTERING CROSS SECTIONS.
        OPTICAL AND STATISTICAL MODEL CALCULATION WAS MADE WITH
        CASTHY/7/.  THE LEVEL SCHEME WAS ASSUMED TO BE THE SAME AS
        THAT OF ES-253 TAKEN FROM REF./9/.
                   NO         ENERGY(KEV)   SPIN-PARITY
                  G.S.            0.0         7/2 +
                    1            48.0         9/2 +
                    2            50.0         3/2 -
                    3           420.0         7/2 -
        LEVELS ABOVE 500 KEV WERE ASSUMED TO BE OVERLAPPING.
        THE LEVEL DENSITY PARAMETERS WERE TAKEN FROM REF./10/.

  MT=16,17,37  (N,2N), (N,3N) AND (N,4N) REACTION CROSS SECTIONS
        CALCULATED WITH EVAPORATION MODEL.

  MT=18  FISSION CROSS SECTION
        MEASURED THERMAL CROSS SECTION OF 13.43 BARNS WAS TAKEN
        FROM REF./11/, AND 1/V FORM WAS ASSUMED BELOW 2.47 EV.
        ABOVE 2.47 EV, THE CROSS SECTION SHAPE WAS ASSUMED TO BE
        THE SAME AS CF-252 FISSION CROSS SECTION AND IT WAS
        NORMALIZED TO THE SYSTEMATICS BY BEHRENS AND HOWERTON/12/.

  MT=102  CAPTURE CROSS SECTION
        MEASURED THERMAL CROSS SECTION OF 55.0 BARNS WAS TAKEN
        FROM REF./11/, AND 1/V FORM WAS ASSUMED BELOW 2.47 EV.
        ABOVE 2.47 EV, CALCULATED WITH CASTHY. THE GAMMA-RAY
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        STRENGTH FUNCTION WAS ESTIMATED FROM GAMMA-GAMMA = 0.040
        EV AND LEVEL SPACING = 4.94 EV.

  MT=251  MU-L
        CALCULATED WITH CASTHY.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,51-53,91         CALCULATED WITH OPTICAL MODEL.
  MT=16,17,18,37        ISOTROPIC IN THE LAB SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,37,91        EVAPORATION SPECTRA.
         OBTAINED FROM LEVEL DENSITY PARAMETERS.

  MT=18                 MAXWELLIAN FISSION SPECTRUM.
         TEMPERATURE WAS ESTIMATED FROM Z**2/A DEPENDENCE/13/.
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13) SMITH A.B. ET AL.: ANL/NDM-50 (1979).
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MAT number = 9936
100-FM-255 TIT         EVAL-AUG87 N.TAKAGI
                       DIST-SEP89 REV2-JUN94
HISTORY
87-08 NEW EVALUATION WAS MADE BY N. TAKAGI (TOKYO INSTITUTE OF
      TECHNOLOGY, TIT) /1/.
94-06 JENDL-3.2.
       NU-P, NU-D AND NU-TOTAL WERE MODIFIED.
      COMPILED BY T.NAKAGAWA (NDC/JAERI)

     *****   MODIFIED PARTS FOR JENDL-3.2   ********************
      (1,452), (1,455), (1,456)
     ***********************************************************


MF=1  GENERAL INFORMATION
  MT=451   COMMENT AND DICTIONARY
  MT=452   NUMBER OF NEUTRONS PER FISSION
        SUM OF NU-P NAD NU-D.
  MT=455   DELAYED NEUTRONS PER FISSION
        AVERAGE VALUES OF SYSTEMATICS BY TUTTLE/2/, BENEDETTI ET
        AL./3/ AND WALDO ET AL./4/  EVALUATION BY BRADY AND
        ENGLAND/5/ WAS ADOPTED FOR THE DECAY CONSTANTS.
  MT=456   PROMPT NEUTRONS PER FISSION
        CALCULATED FROM THE SEMI-EMPIRICAL FORMULA OF HOWERTON/6/.

MF=2  RESONANCE PARAMETERS
  MT=151   RESONANCE PARAMETERS
    NO RESONANCE PARAMETERS WERE GIVEN.

  2200-M/S CROSS SECTIONS AND RESONANCE INTEGRALS
                      2200 M/S VALUE       RES. INT.
        TOTAL          3396.60  B             -
        ELASTIC          10.60  B             -
        FISSION        3360.00  B          1170  B
        CAPTURE          26.00  B           101  B

MF=3  NEUTRON CROSS SECTIONS
  MT=1  TOTAL CROSS SECTION
        BELOW 3.8 EV, CALCULATED AS SUM OF MT'S = 2, 18 AND 102.
        ABOVE 3.8 EV, OPTICAL MODEL CALCULATION WAS MADE WITH
        CASTHY/7/.  THE POTENTIAL PARAMETERS/8/ USED ARE AS
        FOLLOWS,
           V = 43.4 - 0.107*EN                         (MEV)
           WS= 6.95 - 0.339*EN + 0.0531*EN**2          (MEV)
           WV= 0              , VSO = 7.0              (MEV)
           R = RSO = 1.282    , RS = 1.29              (FM)
           A = ASO = 0.60     , B  = 0.5               (FM)

  MT=2  ELASTIC SCATTERING CROSS SECTION
        BELOW 3.8 EV, THE CONSTANT CROSS SECTION OF 10.6 BARNS WAS
        ASSUMED, WHICH WAS THE SHAPE ELASTIC SCATTERING CROSS
        SECTION CALCULATED WITH OPTICAL MODEL. ABOVE THIS ENERGY,
        OPTICAL MODEL CALCULATION WAS ADOPTED.

  MT=4,51,91  INELASTIC SCATTERING CROSS SECTIONS.
        OPTICAL AND STATISTICAL MODEL CALCULATION WAS MADE WITH
        CASTHY/7/.  THE LEVEL SCHEME WAS TAKEN FROM REF./9/.
                   NO          ENERGY(KEV)   SPIN-PARITY
                  G.S.              0           7/2 +
                    1              60           9/2 +
        LEVELS ABOVE 94 KEV WERE ASSUMED TO BE OVERLAPPING.
        THE LEVEL DENSITY PARAMETERS WERE TAKEN FROM REF./10/.

  MT=16,17,37  (N,2N), (N,3N) AND (N,4N) REACTION CROSS SECTIONS
        CALCULATED WITH EVAPORATION MODEL.

  MT=18  FISSION CROSS SECTION
        MEASURED THERMAL CROSS SECTION OF 3360 BARNS WAS TAKEN
        FROM REF./11/, AND 1/V FORM WAS ASSUMED BELOW 3.8 EV.
        ABOVE 3.8 EV, THE SHAPE WAS ASSUMED TO BE THE SAME AS
        BK-250 FISSION CROSS SECTION AND IT WAS NORMALIZED TO THE
        SYSTEMATICS BY BEHRENS AND HOWERTON/12/.

  MT=102  CAPTURE CROSS SECTION
        MEASURED THERMAL CROSS SECTION OF 26 BARNS WAS TAKEN FROM
        REF./11/, AND 1/V FORM WAS ASSUMED BELOW 3.8 EV.  ABOVE
        3.8 EV, CALCULATED WITH CASTHY. THE GAMMA-RAY STRENGTH
        FUNCTION WAS ESTIMATED FROM GAMMA-GAMMA = 0.040 EV AND
        LEVEL SPACING = 7.6 EV.

  MT=251  MU-L
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        CALCULATED WITH CASTHY.

MF=4  ANGULAR DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=2,51,91            CALCULATED WITH OPTICAL MODEL.
  MT=16,17,18,37        ISOTROPIC IN THE LAB SYSTEM.

MF=5  ENERGY DISTRIBUTIONS OF SECONDARY NEUTRONS
  MT=16,17,37,91        EVAPORATION SPECTRA.
         OBTAINED FROM LEVEL DENSITY PARAMETERS.

  MT=18                 MAXWELLIAN FISSION SPECTRUM.
         TEMPERATURE WAS ESTIMATED FROM Z**2/A DEPENDENCE/13/.
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