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## ACTIV87

### Fast Neutron Activation Cross section File

1987

compiled by

V.N. Manokhin, A.B. Pashchenko, V.I. Plyaskin V.M. Bychkov, V.G. Pronyaev

#### Abstract

This document summarizes the content of the Fast neutron Activation Cross Section File based on data from different evaluated data libraries and individual evaluations in ENDF/B-5 format. The entire file or selective retrievals from it are available on magnetic tape, free of charge, from the IAEA Nuclear Data Section.

O. Schwerer (ed.)

October 1989

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**Note:**

The IAEA-NDS-reports should not be considered as formal publications. When a nuclear data library is sent out by the IAEA Nuclear Data Section, it will be accompanied by an IAEA-NDS-report which should give the data user all necessary documentation on contents, format and origin of the data library.

IAEA-NDS-reports are updated whenever there is additional information of relevance to the users of the data library.

For citations care should be taken that credit is given to the author of the data library and/or to the data center which issued the data library. The editor of the IAEA-NDS-report is usually not the author of the data library.

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96/11

**Citation guidelines:**

ACTIV87

Fast Neutron Activation Cross Section File

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Revised by P.K.McLaughlin IAEA/NDS Jan. 2005

The file was revised to conform with ENDF/B format standards. All reactions of the same material were merged into a single material with the bibliography for each reaction given in File 1/451. The merged file was corrected for format errors and processed through the 2002 pre-processing codes FIXUP and DICTIN and finally through the code CHECKR to ensure format compatibility.

INTRODUCTION

This compilation of fast neutron induced activation reaction cross-sections, covering energies from threshold to 20 KeV, is based on evaluated data taken from different evaluated data libraries and individual evaluations. The majority of these evaluations were prepared by using available experimental data for selecting the parameters needed in theoretical computations and for normalizing the results of such computations. Theoretical calculations were also used for interpolation and extrapolation of experimental cross-section data.

The following libraries and individual files of evaluated neutron cross-section data were used for the selection of the activation cross-sections: the BOSPOR Library [1], the Activation File of the Evaluated Nuclear Data Library [2], the Evaluated Neutron Data File (ENDF/B-V) Activation File [3], the International Reactor Dosimetry File (IRDF-82) [4] and individual evaluations carried out under various IAEA research contracts. All of the evaluated data curves were compared with experimental data that have been reported over the last four years. Only those cross-sections not in contradiction with the latest experimental data were retained in the present activation data file. In cases of several conflicting evaluations, that evaluation was chosen which best corresponded to the experimental data. A few evaluated curves were renormalized in accordance with the results of the latest precision measurements.

The file of selected reactions contains 206 evaluated cross-section curves of the (n,2n), (n,p) and (n,c) reactions which lead to radioactive products and may be used in many practical applications of neutron activation analysis. Some competing activation reactions, usually with low cross-section values, are given for completeness.

\*The data are in ENDF/B-5 format. However, it should be noted that the arrangement of the evaluations does not conform to the rules of an ENDF/B-5 file in so far as in some cases, the same MAT number appears twice, giving data for 2 reactions (e.g. (n,p) and (n,2n) separately).

\* See revision note above.

The entire file, or selective retrievals from it, are available on magnetic tape, free of charge, from the IAEA Nuclear Data Section. Retrievals of limited size are available also in listing form. Graphical plots of the data are shown in chapter 2.3 of the 1987 Handbook of Nuclear Activation Data [5]. On the following pages, an index (on reaction level) is given, using the following conventions:

CS            =    cross sections  
COV           =    covariance file  
8,9,10       =    data for radioactive nuclide production  
                  (ENDF/B file nos. 8,9,10)

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[1] included in the INDL/V library, see IAEA-HDS-31

[2] see IAEA-NDS-55

3] see IAEA-NDS-38

[4] see IAEA-NDS-41

[5] V.N. Kanokhin, A.B. Pashchenko, V.I. Plyaskin, V.K. Bychkov, V.G. Pronyaev, Handbook on Nuclear Activation Data, Technical Report Series No.273. IAEA. Vienna, 1987, pp. 305-411.

## ACTIVATION DATA HANDBOOK LIBRARY      ACTIV87

			DATA TYPE	NO.RECS.	MAT.NO.
3-LI- 6	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.		330
			TITLE INFORM.	38	330
			CS (N,2N)	47	330
			CS (N,P)	60	330
4-BE- 9	1USALRL	EVAL- 71			435
			TITLE INFORM.	14	435
			CS (N,A)	8	435
5-B-10	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.		530
			TITLE INFORM.	35	530
			CS (N,T)	66	530
6-C -12	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.		630
			TITLE INFORM.	35	630
			CS (N,P)	23	630
7-N-14	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.		730
			TITLE INFORM.	37	730
			CS (N,2N)	32	730
8-O -16	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.		830
			TITLE INFORM.	37	830
			CS (N,P)	35	830
9-F-19	3AUSIRK	EVAL- 79	S.TAGESEN,H.VONACH,B.STROHMAIER		920
			TITLE INFORM.	32	920
			CS (N,2N)	34	920
			COV (N,2N)	46	920
9-F-19	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.		930
			TITLE INFORM.	40	930
			CS (N,P)	55	930
			CS (N,A)	60	930
11-NA-23	3POLIBJ	EVAL-FEB79	ADAMSKI, HERMAN AND MARCINKOWSKI		1120
			TITLE INFORM.	50	1120
			CS (N,2N)	11	1120
			COV (N,2N)	11	1120
11-NA-23	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.		1130
			TITLE INFORM.	40	1130
			CS (N,P)	57	1130
			CS (N,A)	50	1130
12-MG-24	3AUSIRK	EVAL- 79	S.TAGESEN,H.VONACH,B.STROHMAIER		1220
			TITLE INFORM.	79	1220
			CS (N,P)	54	1220
			COV (N,P)	154	1220
12-MG- 25	1USALRL	EVAL- 76			1236
			TITLE INFORM.	14	1236
			CS (N,P)	7	1236
12-MG- 26	1USALRL	EVAL- 76			1235
			TITLE INFORM.	14	1235
			CS (N,A)	6	1235
13-AL- 270	LASL	EVAL-DEC73	P.G. YOUNG; D.G. FOSTER, JR.		6313

			TITLE INFORM.	64	6313
			CS (N,P)	118	6313
			CS (N,A)	186	6313
			COV (N,P)	18	6313
			COV (N,A)	15	6313
14-SI-28	4POLINR	EVAL-	83 L.ADAMSKI,M.HERMAN ET AL.	1450	
			TITLE INFORM.	20	1450
			CS (N,P)	53	1450
14-SI-30	1USALRL	EVAL-	76		1436
			TITLE INFORM.	14	1436
			CS (N,A)	10	1436
15-P-31	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	1530	
			TITLE INFORM.	40	1530
			CS (N,2N)	28	1530
			CS (N,A)	55	1530
15-P-31	3AUSIRK	EVAL-	79 S.TAGESEN,H.VONACH,B.STROHMAIER	1520	
			TITLE INFORM.	37	1520
			CS (N,P)	65	1520
			COV (N,P)	108	1520
16-S-32	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	1630	
			TITLE INFORM.	41	1630
			CS (N,2N)	19	1630
16-S-32	BNL	EVAL-APR79	DIVADEENAM		6439
			TITLE INFORM.	38	6439
			CS (N,P)	27	6439
			COV (N,P)	13	6439
16-S-33	1USALRL	EVAL-	76		1635
			TITLE INFORM.	14	1635
			CS (N,P)	11	1635
16-S-34	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	1640	
			TITLE INFORM.	36	1640
			CS (N,P)	9	1640
			CS (N,A)	54	1640
17-CL-35	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	1730	
			TITLE INFORM.	41	1730
			CS (N,2N)	27	1730
			CS (N,2N)-M	27	1730
			CS (N,A)	61	1730
17-CL-37	1USALRL	EVAL-	76		1735
			TITLE INFORM.	14	1735
			CS (N,A)	11	1735
18-AR-40	1USALRL	EVAL-	76		1835
			TITLE INFORM.	14	1835
			CS (N,2N)	10	1835
19-K-39	1USALRL	EVAL-	76		1935
			TITLE INFORM.	14	1935
			CS (N,2N)	8	1935
19-K-39	1USALRL	EVAL-	76		1935
			TITLE INFORM.	14	1935
			CS (N,2N)-M	7	1935

19-K-39	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	1930	
			TITLE INFORM.	40	1930
			CS (N,P)	67	1930
			CS (N,A)	61	1930
19-K-41	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	1940	
			TITLE INFORM.	38	1940
			CS (N,P)	60	1940
			CS (N,A)	56	1940
20-CA-40	1USALRL	EVAL-	76		2035
			TITLE INFORM.	14	2035
			CS (N,A)	7	2035
20-CA-42	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	2030	
			TITLE INFORM.	35	2030
			CS (N,P)	58	2030
20-CA-42	1USALRL	EVAL-	76		2036
			TITLE INFORM.	14	2036
			CS (N,A)	5	2036
20-CA-44	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	2040	
			TITLE INFORM.	38	2040
			CS (N,P)	49	2040
			CS (N,A)	47	2040
20-CA-46	1USALRL	EVAL-	76		2037
			TITLE INFORM.	14	2037
			CS (N,P)	5	2037
20-CA-46	1USALRL	EVAL-	76		2037
			TITLE INFORM.	14	2037
			CS (N,A)	5	2037
20-CA-48	1USALRL	EVAL-	76		2038
			TITLE INFORM.	14	2038
			CS (N,P)	5	2038
21-SC-45	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	2130	
			TITLE INFORM.	46	2130
			CS (N,2N)	11	2130
			CS (N,2N)-M	30	2130
			CS (N,P)	68	2130
			CS (N,A)	50	2130
22-TI-46	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	2230	
			TITLE INFORM.	38	2230
			CS (N,2N)	25	2230
			CS (N,P)	61	2230
22-TI-47	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	2240	
			TITLE INFORM.	35	2240
			CS (N,P)	67	2240
22-TI-47	ANL	EVAL-JAN77	C.PHILIS,O.BERSILLON,D.SMITH,ETC	6428	
			TITLE INFORM.	37	6428
			CS (N,N+P)	25	6428
			COV (N,N+P)	4	6428
22-TI-48	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	2250	
			TITLE INFORM.	35	2250
			CS (N,P)	54	2250

22-TI- 48	1USALRL	EVAL-	76		2235
				TITLE INFORM.	14
				CS (N,A)	9
					2235
22-TI- 48	ANL	EVAL-JAN77	C.PHILIS,O.BERSILLON,D.SMITH ETC.		6429
				TITLE INFORM.	39
				CS (N,N+P)	17
				COV (N,N+P)	4
					6429
22-TI-49	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.		2260
				TITLE INFORM.	35
				CS (N,P)	60
					2260
22-TI-50	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.		2270
				TITLE INFORM.	35
				CS (N,P)	44
					2270
22-TI- 50	1USALRL	EVAL-	76		2236
				TITLE INFORM.	14
				CS (N,A)	9
					2236
23-V-51	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.		2330
				TITLE INFORM.	37
				CS (N,P)	9
				CS (N,A)	47
					2330
24-CR-50	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.		2440
				TITLE INFORM.	35
				CS (N,2N)	26
					2440
24-CR-52	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.		2420
				TITLE INFORM.	42
				CS (N,2N)	30
				CS (N,P)	45
					2420
24-CR- 53	1USALRL	EVAL-	76		2436
				TITLE INFORM.	14
				CS (N,N+P)	6
					2436
24-CR- 54	1USALRL	EVAL-	76		2437
				TITLE INFORM.	14
				CS (N,A)	10
					2437
25-MN-55	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.		2530
				TITLE INFORM.	35
				CS (N,2N)	35
					2530
25-MN- 55	1USALRL	EVAL-	77		2535
				TITLE INFORM.	14
				CS (N,P)	10
					2535
25-MN- 55	4CCPFEI	EVAL-	80		2535
				TITLE INFORM.	14
				CS (N,A)	8
					2535
26-FE-54	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.		2610
				TITLE INFORM.	43
				CS (N,2N)	24
				CS (N,P)	66
				CS (N,A)	64
					22610
26-FE-56	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.		2620
				TITLE INFORM.	39
					2620

		CS	(N,2N)	32	22620
26-FE- 56	ORNL	EVAL-JUL78	C.Y.FU		6431
		TITLE INFORM.		45	6431
		CS	(N,P)	77	6431
		COV	(N,P)	32	6431
					6431
26-FE- 57	1USALRL	EVAL-	76		2635
		TITLE INFORM.		14	2635
		CS	(N,P)	10	2635
26-FE- 58	1USALRL	EVAL-	76		2636
		TITLE INFORM.		14	2636
		CS	(N,A)	9	2636
27-CO- 59	1USALRL	EVAL-	76		2735
		TITLE INFORM.		14	2735
		CS	(N,2N)-M	8	2735
27-CO- 59	BNL	EVAL-JUN77	S.MUGHABGHAB		6327
		TITLE INFORM.		96	6327
		CS	(N,2N)	8	6327
		COV	(N,2N)	8	6327
27-CO-59	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	2730	
		TITLE INFORM.		40	2730
		CS	(N,P)	59	2730
		CS	(N,A)	54	2730
28-NI-58	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	2820	
		TITLE INFORM.		44	2820
		CS	(N,2N)	28	22820
		CS	(N,D)	47	22820
		CS	(N,A)	61	22820
28-NI- 58	1USALRL	EVAL-	76		2835
		TITLE INFORM.		14	2835
		CS	(N,P)-M	11	2835
28-NI- 58	BNL	EVAL-MAR77	M.DIVADEENAM		6433
		TITLE INFORM.		67	6433
		CS	(N,P)	66	6433
		COV	(N,P)	10	26433
28-NI- 60	BNL	EVAL-MAY78	DIVADEENAM		7280
		TITLE INFORM.		31	7280
		RES.INFORM.		4	7280
		CS	(N,2N)	10	7280
		CS	(N,P)	16	7280
		8	(N,2N)	3	7280
		8	(N,P)	3	7280
		9	(N,P)	21	7280
		10	(N,2N)	10	7280
28-NI- 60	1USALRL	EVAL-	76		2836
		TITLE INFORM.		14	2836
		CS	(N,P)-M	10	2836
28-NI-60	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	2830	
		TITLE INFORM.		37	2830
		CS	(N,P)	58	22830

28-NI- 61	1USALRL	EVAL-	76		2837
			TITLE INFORM.	14	2837
			CS (N,P)	9	2837
28-NI- 62	1USALRL	EVAL-	76		2838
			TITLE INFORM.	14	2838
			CS (N,P)	8	2838
28-NI- 62	1USALRL	EVAL-	76		2838
			TITLE INFORM.	14	2838
			CS (N,P)-M	8	2838
28-NI-62	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.		2840
			TITLE INFORM.	35	2840
			CS (N,A)	45	2840
28-NI- 64	1USALRL	EVAL-	76		2839
			TITLE INFORM.	14	2839
			CS (N,P)	7	2839
28-NI- 64	1USALRL	EVAL-	76		2839
			TITLE INFORM.	14	2839
			CS (N,A)	7	2839
29-CU-63	3AUSIRK	EVAL-	79	S.TAGESEN,H.VONACH,B.STROHMAIER	2920
			TITLE INFORM.	99	2920
			CS (N,2N)	33	2920
			COV (N,2N)	35	2920
29-CU- 63	1USALRL	EVAL-	76		2935
			TITLE INFORM.	14	2935
			CS (N,P)	12	2935
29-CU- 63	4CCPFEI	EVAL-	80	V.M.BYCHKOV ET AL.	2930
			TITLE INFORM.	14	2930
			CS (N,A)	9	2930
29-CU- 63	1USALRL	EVAL-	76		2935
			TITLE INFORM.	14	2935
			CS (N,A)	12	2935
29-CU-65	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.		2930
			TITLE INFORM.	38	2930
			CS (N,2N)	37	2930
			CS (N,P)	60	2930
29-CU- 65	1USALRL	EVAL-	76		2936
			TITLE INFORM.	14	2936
			CS (N,A)	12	2936
29-CU- 65	1USALRL	EVAL-	76		2936
			TITLE INFORM.	14	2936
			CS (N,A)-M	12	2936
30-ZN-64	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.		3010
			TITLE INFORM.	37	3010
			CS (N,2N)	29	23010
30-ZN-64	3AUSIRK	EVAL-	79	S.TAGESEN,H.VONACH,B.STROHMAIER	3020
			TITLE INFORM.	95	3020
			CS (N,P)	67	3020
			COV (N,P)	103	3020
30-ZN-66	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.		3040
			TITLE INFORM.	38	3040

			CS	(N,2N)	34	3040
			CS	(N,P)	56	3040
30-ZN-68	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.			3070
			TITLE INFORM.			35 3070
			CS	(N,A)	9	3070
31-GA-69	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.			3130
			TITLE INFORM.			36 3130
			CS	(N,2N)	35	3130
			CS	(N,P)-M	9	3130
31-GA-71	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.			3140
			TITLE INFORM.			35 3140
			CS	(N,2N)	38	3140
32-GE-70	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.			3230
			TITLE INFORM.			35 3230
			CS	(N,2N)	31	3230
32-GE- 70	1USALRL	EVAL-	82			3235
			TITLE INFORM.			14 3235
			CS	(N,P)	10	3235
32-GE- 72	1USALRL	EVAL-	82			3236
			TITLE INFORM.			14 3236
			CS	(N,2N)	9	3236
32-GE- 72	1USALRL	EVAL-	82			3236
			TITLE INFORM.			14 3236
			CS	(N,P)	10	3236
32-GE- 73	1USALRL	EVAL-	82			3237
			TITLE INFORM.			14 3237
			CS	(N,P)	11	3237
32-GE- 74	1USALRL	EVAL-	82			3238
			TITLE INFORM.			14 3238
			CS	(N,P)	10	3238
32-GE- 74	1USALRL	EVAL-	82			3238
			TITLE INFORM.			14 3238
			CS	(N,A)	9	3238
32-GE- 76	1USALRL	EVAL-	82			3239
			TITLE INFORM.			14 3239
			CS	(N,P)	9	3239
32-GE- 76	1USALRL	EVAL-	82			3239
			TITLE INFORM.			14 3239
			CS	(N,A)	9	3239
32-GE-76	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.			3240
			TITLE INFORM.			35 3240
			CS	(N,2N)	38	3240
33-AS-75	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.			3330
			TITLE INFORM.			41 3330
			CS	(N,2N)	36	3330
			CS	(N,P)	57	3330
			CS	(N,A)	45	3330
34-SE-74	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.			3430

			CS	(N,2N)	34	3040
			CS	(N,P)	56	3040
30-ZN-68	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.			3070
			TITLE INFORM.			35 3070
			CS	(N,A)	9	3070
31-GA-69	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.			3130
			TITLE INFORM.			36 3130
			CS	(N,2N)	35	3130
			CS	(N,P)-M	9	3130
31-GA-71	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.			3140
			TITLE INFORM.			35 3140
			CS	(N,2N)	38	3140
32-GE-70	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.			3230
			TITLE INFORM.			35 3230
			CS	(N,2N)	31	3230
32-GE- 70	1USALRL	EVAL-	82			3235
			TITLE INFORM.			14 3235
			CS	(N,P)	10	3235
32-GE- 72	1USALRL	EVAL-	82			3236
			TITLE INFORM.			14 3236
			CS	(N,2N)	9	3236
32-GE- 72	1USALRL	EVAL-	82			3236
			TITLE INFORM.			14 3236
			CS	(N,P)	10	3236
32-GE- 73	1USALRL	EVAL-	82			3237
			TITLE INFORM.			14 3237
			CS	(N,P)	11	3237
32-GE- 74	1USALRL	EVAL-	82			3238
			TITLE INFORM.			14 3238
			CS	(N,P)	10	3238
32-GE- 74	1USALRL	EVAL-	82			3238
			TITLE INFORM.			14 3238
			CS	(N,A)	9	3238
32-GE- 76	1USALRL	EVAL-	82			3239
			TITLE INFORM.			14 3239
			CS	(N,P)	9	3239
32-GE- 76	1USALRL	EVAL-	82			3239
			TITLE INFORM.			14 3239
			CS	(N,A)	9	3239
32-GE-76	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.			3240
			TITLE INFORM.			35 3240
			CS	(N,2N)	38	3240
33-AS-75	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.			3330
			TITLE INFORM.			41 3330
			CS	(N,2N)	36	3330
			CS	(N,P)	57	3330
			CS	(N,A)	45	3330
34-SE-74	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.			3430

			CS	(N,2N)	34	3040
			CS	(N,P)	56	3040
30-ZN-68	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.			3070
			TITLE INFORM.			35 3070
			CS	(N,A)	9	3070
31-GA-69	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.			3130
			TITLE INFORM.			36 3130
			CS	(N,2N)	35	3130
			CS	(N,P)-M	9	3130
31-GA-71	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.			3140
			TITLE INFORM.			35 3140
			CS	(N,2N)	38	3140
32-GE-70	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.			3230
			TITLE INFORM.			35 3230
			CS	(N,2N)	31	3230
32-GE- 70	1USALRL	EVAL-	82			3235
			TITLE INFORM.			14 3235
			CS	(N,P)	10	3235
32-GE- 72	1USALRL	EVAL-	82			3236
			TITLE INFORM.			14 3236
			CS	(N,2N)	9	3236
32-GE- 72	1USALRL	EVAL-	82			3236
			TITLE INFORM.			14 3236
			CS	(N,P)	10	3236
32-GE- 73	1USALRL	EVAL-	82			3237
			TITLE INFORM.			14 3237
			CS	(N,P)	11	3237
32-GE- 74	1USALRL	EVAL-	82			3238
			TITLE INFORM.			14 3238
			CS	(N,P)	10	3238
32-GE- 74	1USALRL	EVAL-	82			3238
			TITLE INFORM.			14 3238
			CS	(N,A)	9	3238
32-GE- 76	1USALRL	EVAL-	82			3239
			TITLE INFORM.			14 3239
			CS	(N,P)	9	3239
32-GE- 76	1USALRL	EVAL-	82			3239
			TITLE INFORM.			14 3239
			CS	(N,A)	9	3239
32-GE-76	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.			3240
			TITLE INFORM.			35 3240
			CS	(N,2N)	38	3240
33-AS-75	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.			3330
			TITLE INFORM.			41 3330
			CS	(N,2N)	36	3330
			CS	(N,P)	57	3330
			CS	(N,A)	45	3330
34-SE-74	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.			3430

			TITLE INFORM.	35	3430
			CS (N,P)	9	3430
34-SE-76	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	3440	
			TITLE INFORM.	35	3440
			CS (N,2N)	32	3440
35-BR-79	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	3530	
			TITLE INFORM.	36	3530
			CS (N,2N)	34	3530
			CS (N,A)	9	3530
35-BR-81	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	3540	
			TITLE INFORM.	38	3540
			CS (N,2N)	35	3540
			CS (N,2N)-M	33	3540
37-RB-85	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	3730	
			TITLE INFORM.	36	3730
			CS (N,2N)	35	3730
			CS (N,A)	35	3730
37-RB-87	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	3740	
			TITLE INFORM.	35	3740
			CS (N,2N)	36	3740
38-SR-84	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	3830	
			TITLE INFORM.	35	3830
			CS (N,2N)	30	3830
38-SR-86	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	3850	
			TITLE INFORM.	35	3850
			CS (N,P)	9	3850
38-SR-88	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	3840	
			TITLE INFORM.	36	3840
			CS (N,2N)-M	32	3840
			CS (N,P)	8	3840
39-Y-89	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	3930	
			TITLE INFORM.	36	3930
			CS (N,2N)	31	3930
			CS (N,P)	9	3930
40-ZR-90	3AUSIRK	EVAL- 79	S.TAGESEN,H.VONACH,B.STROHMAIER	4020	
			TITLE INFORM.	99	4020
			CS (N,2N)	30	4020
			COV (N,2N)	42	4020
40-ZR- 92	1USALRL	EVAL- 76		4035	
			TITLE INFORM.	14	4035
			CS (N,P)	9	4035
40-ZR-92	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	4080	
			TITLE INFORM.	35	4080
			CS (N,A)	9	4080
40-ZR- 94	1USALRL	EVAL- 76		4036	
			TITLE INFORM.	14	4036
			CS (N,P)	9	4036
40-ZR-94	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	4070	
			TITLE INFORM.	35	4070

			CS	(N,A)	8	4070
41-NB-93	3AUSIRK	EVAL-	79	S.TAGESEN,H.VONACH,B.STROHMAIER		4120
				TITLE INFORM.	37	4120
				CS	(N,INL)-M 80	4120
				COV	(N,INL)-M 140	4120
41-NB-93	4CCPFEI	EVAL-NOV78		V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.		4130
				TITLE INFORM.	37	4130
				CS	(N,2N)-M 40	4130
42-MO-92	1USALRL	EVAL-	76			4235
				TITLE INFORM.	14	4235
				CS	(N,P)-M 14	4235
42-MO-94	1USALRL	EVAL-	76			4236
				TITLE INFORM.	14	4236
				CS	(N,2N) 7	4236
42-MO-95	3RUMPIT	EVAL-JUN83		M. IVASCU,M. AND V.AVRIGEANU		4250
				TITLE INFORM.	28	4250
				CS	(N,P) 10	4250
42-MO-96	3RUMPIT	EVAL-JUN83		M. IVASCU,M. AND V.AVRIGEANU		4260
				TITLE INFORM.	29	4260
				CS	(N,N+P) 8	4260
				CS	(N,P) 10	4260
42-MO-97	3RUMPIT	EVAL-JUN83		M. IVASCU,M. AND V.AVRIGEANU		4270
				TITLE INFORM.	29	4270
				CS	(N,N+P) 8	4270
				CS	(N,P) 10	4270
42-MO-98	3RUMPIT	EVAL-JUN83		M. IVASCU,M. AND V.AVRIGEANU		4280
				TITLE INFORM.	28	4280
				CS	(N,N+P) 7	4280
43-TC-99	1USALRL	EVAL-	82			4335
				TITLE INFORM.	14	4335
				CS	(N,P) 11	4335
43-TC-99	1USALRL	EVAL-	82			4335
				TITLE INFORM.	14	4335
				CS	(N,A) 6	4335
45-RH-103	3AUSIRK	EVAL-	79	S.TAGESEN,H.VONACH,B.STROHMAIER		4520
				TITLE INFORM.	37	4520
				CS	(N,INL)-M 82	4520
				COV	(N,INL)-M 103	4520
45-RH-103	4CCPFEI	EVAL-NOV78		V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.		4530
				TITLE INFORM.	35	4530
				CS	(N,2N) 38	4530
47-AG-107	1USALRL	EVAL-	73			4735
				TITLE INFORM.	14	4735
				CS	(N,2N) 6	4735
47-AG-107	1USALRL	EVAL-	73			4735
				TITLE INFORM.	14	4735
				CS	(N,A)-M 5	4735
47-AG-109	4CCPFEI	EVAL-NOV78		V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.		4730

		TITLE INFORM.	35	4730
		CS (N,P)	9	4730
47-AG-109	1USALRL	EVAL- 73		4736
		TITLE INFORM.	14	4736
		CS (N,A)	7	4736
48-CD-106	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	4830
		TITLE INFORM.	36	4830
		CS (N,2N)	7	4830
		CS (N,2N)-M	32	4830
48-CD-111	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	4840
		TITLE INFORM.	35	4840
		CS (N,P)	46	4840
48-CD-112	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	4850
		TITLE INFORM.	35	4850
		CS (N,A)	40	4850
49-IN-115	HEDL/ANL	EVAL-JAN78	F.SCHMITTROTH/D.L.SMITH	6437
		TITLE INFORM.	80	6437
		CS (N,INL)-M	74	6437
		COV (N,INL)-M	9	6437
49-IN-115	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	4940
		TITLE INFORM.	38	4940
		CS (N,2N)	40	4940
		CS (N,2N)-M	39	4940
50-SN-112	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	5030
		TITLE INFORM.	35	5030
		CS (N,2N)	33	5030
51-SB-123	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	5140
		TITLE INFORM.	35	5140
		CS (N,2N)	40	5140
53-I-127	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	5310
		TITLE INFORM.	35	5310
		CS (N,2N)	40	25310
55-CS-133	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	5530
		TITLE INFORM.	35	5530
		CS (N,2N)	39	5530
58-CE-140	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	5830
		TITLE INFORM.	38	5830
		CS (N,2N)	40	5830
		CS (N,2N)-M	37	5830
58-CE-142	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	5840
		TITLE INFORM.	35	5840
		CS (N,2N)	47	5840
59-PR-141	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	5930
		TITLE INFORM.	35	5930
		CS (N,2N)	39	5930
60-ND-142	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	6030
		TITLE INFORM.	35	6030
		CS (N,2N)	37	6030

60-ND-148	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	6050	
			TITLE INFORM.	37	6050
			CS (N,2N)	45	6050
60-ND-150	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	6060	
			TITLE INFORM.	37	6060
			CS (N,2N)	21	6060
62-SM-144	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	6230	
			TITLE INFORM.	35	6230
			CS (N,2N)	34	6230
62-SM-148	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	6240	
			TITLE INFORM.	35	6240
			CS (N,2N)	43	6240
62-SM-152	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	6260	
			TITLE INFORM.	35	6260
			CS (N,2N)	42	6260
62-SM-154	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	6270	
			TITLE INFORM.	35	6270
			CS (N,2N)	44	6270
67-HO-165	1USALRL	EVAL-	76		6735
			TITLE INFORM.	14	6735
			CS (N,2N)	12	6735
67-HO-165	1USALRL	EVAL-	76		6735
			TITLE INFORM.	14	6735
			CS (N,2N)-M	12	6735
67-HO-165	1USALRL	EVAL-	76		6735
			TITLE INFORM.	14	6735
			CS (N,P)	8	6735
69-TM-169	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	6930	
			TITLE INFORM.	35	6930
			CS (N,2N)	43	6930
71-LU-175	1USALRL	EVAL-	77		7135
			TITLE INFORM.	14	7135
			CS (N,2N)	13	7135
71-LU-175	1USALRL	EVAL-	77		7135
			TITLE INFORM.	14	7135
			CS (N,2N)-M	13	7135
71-LU-176	1USALRL	EVAL-	77		7136
			TITLE INFORM.	14	7136
			CS (N,3N)	9	7136
71-LU-176	1USALRL	EVAL-	77		7136
			TITLE INFORM.	14	7136
			CS (N,3N)-M	9	7136
72-HF-179	1USALRL	EVAL-	76		7235
			TITLE INFORM.	14	7235
			CS (N,P)	15	7235
72-HF-180	1USALRL	EVAL-	76		7236
			TITLE INFORM.	14	7236
			CS (N,P)	13	7236

73-TA-181	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV ET AL.L.ADAMSKI ET	7330
			TITLE INFORM.	40
			CS (N,2N)-M	8
			CS (N,P)	37
				7330
				7330
74- W-180	1USALRL	EVAL-	76	7435
			TITLE INFORM.	14
			CS (N,2N)	9
				7435
				7435
74- W-182	1USALRL	EVAL-	76	7436
			TITLE INFORM.	14
			CS (N,2N)	10
				27436
				7436
74- W-182	1USALRL	EVAL-	76	7436
			TITLE INFORM.	14
			CS (N,P)	12
				7436
				7436
74- W-183	1USALRL	EVAL-	76	7437
			TITLE INFORM.	14
			CS (N,N+P)	13
				7437
				7437
74- W-183	1USALRL	EVAL-	76	7437
			TITLE INFORM.	14
			CS (N,P)	11
				7437
				7437
74- W-184	1USALRL	EVAL-	82	7438
			TITLE INFORM.	14
			CS (N,N+P)	7
				7438
				7438
74- W-184	1USALRL	EVAL-	76	7438
			TITLE INFORM.	14
			CS (N,P)	12
				7438
				7438
74- W-184	1USALRL	EVAL-	76	7438
			TITLE INFORM.	14
			CS (N,A)	13
				7438
				7438
74- W-186	1USALRL	EVAL-	76	7439
			TITLE INFORM.	14
			CS (N,2N)	11
				7439
				7439
74- W-186	1USALRL	EVAL-	76	7439
			TITLE INFORM.	14
			CS (N,P)	11
				7439
				7439
74- W-186	1USALRL	EVAL-	76	7439
			TITLE INFORM.	14
			CS (N,A)	13
				7439
				7439
75-RE-185	1USALRL	EVAL-	76	7535
			TITLE INFORM.	14
			CS (N,2N)	12
				7535
				7535
75-RE-185	1USALRL	EVAL-	76	7535
			TITLE INFORM.	14
			CS (N,2N)-M	9
				7535
				7535
79-AU-197	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	7930
			TITLE INFORM.	37
			CS (N,2N)	13
				7930
				7930
79-AU-197	1USALRL	EVAL-	76	7935

			TITLE INFORM.	14	7935
			CS (N,2N)-M	6	7935
79-AU-197	1USALRL	EVAL-	82		7935
			TITLE INFORM.	14	7935
			CS (N,P)	6	7935
80-HG-202	1USALRL	EVAL-	82		8035
			TITLE INFORM.	14	8035
			CS (N,P)	9	8035
80-HG-202	1USALRL	EVAL-	82		8035
			TITLE INFORM.	14	8035
			CS (N,A)	6	8035
80-HG-204	1USALRL	EVAL-	82		8036
			TITLE INFORM.	14	8036
			CS (N,2N)	12	8036
80-HG-204	1USALRL	EVAL-	82		8036
			TITLE INFORM.	14	8036
			CS (N,P)	8	8036
80-HG-204	1USALRL	EVAL-	82		8036
			TITLE INFORM.	14	8036
			CS (N,A)	6	8036
81-TL-203	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	8110	
			TITLE INFORM.	35	8110
			CS (N,2N)	44	28110
81-TL-203	1USALRL	EVAL-	82		8135
			TITLE INFORM.	14	8135
			CS (N,P)	10	8135
81-TL-205	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	8140	
			TITLE INFORM.	35	8140
			CS (N,2N)	44	8140
81-TL-205	1USALRL	EVAL-	82		8136
			TITLE INFORM.	14	8136
			CS (N,P)	9	8136
82-PB-204	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	8230	
			TITLE INFORM.	35	8230
			CS (N,2N)	41	8230
82-PB-204	1USALRL	EVAL-	81		8235
			TITLE INFORM.	14	8235
			CS (N,P)	9	8235
82-PB-207	1USALRL	EVAL-	81		8237
			TITLE INFORM.	14	8237
			CS (N,P)	8	8237
82-PB-208	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	8240	
			TITLE INFORM.	35	8240
			CS (N,2N)-M	40	8240
83-BI-209	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.	8330	
			TITLE INFORM.	35	8330
			CS (N,2N)	45	8330

83-BI-209	1USALRL	EVAL-	82		8335
				TITLE INFORM.	14
				CS (N,P)	7
90-TH-232	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.		9030
				TITLE INFORM.	35
				CS (N,2N)	49
92-U-238	4CCPFEI	EVAL-NOV78	V.M.BYCHKOV,K.I.ZOLOTAREV ET AL.		9230
				TITLE INFORM.	35
				CS (N,2N)	50

