

HIB-SECTION

REFERENCE (C,6RWASH,2,885,6803) P
 CONTRIBUTION.
 (P,EANDC(E)-89,37,6802)
 (J,NP/A,11A,9,6805) FINA
 MEASUREMENTS.
 AUTHOR (H.K. VONACH, W.G. VONACH, H
 TITLE -PRECISION MEASUREMENTS
 OF (N,P), (N,A) AND (N,
 13.5 - 14.7 MEV NEUTRON
 INSTITUTE (2GERMUN)
 N-SOURCE (D-T) BOMBARDMENT OF A
 DEUTERONS. A RANGE OF
 WERE USED BY VARYING THE
 FACILITY (VDG) 400KEV VAN DE GR
 FUR STRAHLENFORSCHUNG.
 METHOD (ACTIV) GAMMA PULSES EX
 TA-180M WHERE BETAS WERE
 PART-DET (DG) DECAY GAMMAS.
 SAMPLE .NATURAL MATERIALS. ME
 SAMPLES WERE PLACED AT
 CORRESPONDING TO 30
 ENERGY, AND SURTENDED
 DISTANCE OF 100MM
 CORRECTION .ANGULAR DEPENDENT NE
 ELASTICALLY SCATTERED
 SCATTERING CONTRIBUT
 DECAY CORRECTIONS.
 ERR-ANALYS .SYSTEMATIC ERRORS, TA
 ATTENUATION CORRECTION
 (0.05 PC), DECAY CORRE
 SHIFTS (0.1 PC). MAXIMUM
 THAN 0.9 PERCENT. STATIS
 IN THE TOTAL ERROR.
 DETECTOR (NAICR) 5X5 INCH WELL CRYST
 (PROPC) CH4 FLOW COUNTER
 TA-180M.
 STATUS .FROM TABLES IN CONFERENCE
 HISTORY (781017C) PDJ. RECOMPILED
 (790219E)
 (800115A) REACTION STRING
 022 AND 023 CHANGED.
 (800115F)
 (800424A) DATA HEADINGS COM
 (800603E)

END BIR-SECTION *****

BIR-SECTION

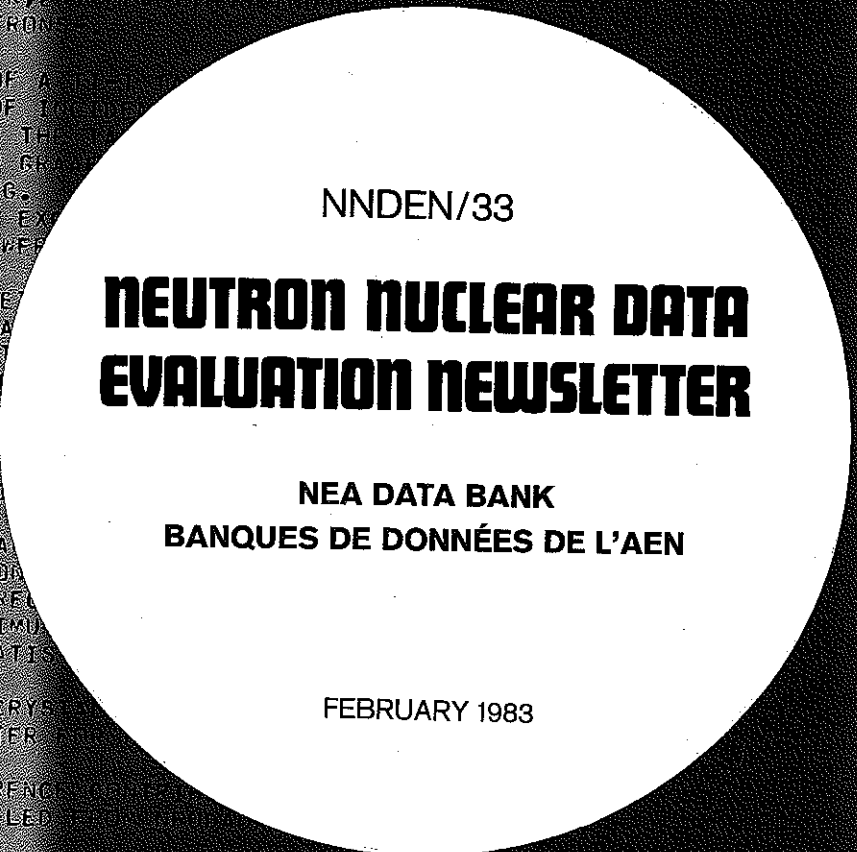
REACTION (23-V-51(N,A)21-SC-48,, STG
 RATIO TO THE 14.7 MEV CROSS
 STATUS .PUBLISHED TABLE.
 HISTORY (781018C) PDJ.
 (790219E)
 (800424A) DATA HEADINGS COM
 (800603F)

END BIR-SECTION *****

NO COMMON-SECTION *****

	EN MEV	EN-ERR MEV	DATA ARR-UNITS
1	13.6	0.075	0.820
2	13.7	0.075	0.836
3	13.8	0.075	0.852
4	13.9	0.075	0.867
5	14.0	0.075	0.885
6	14.1	0.075	0.902

END DATA-SECTION *****



NNDEN/33

NEUTRON NUCLEAR DATA EVALUATION NEWSLETTER

NEA DATA BANK
BANQUES DE DONNÉES DE L'AEN

FEBRUARY 1983

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NEUTRON NUCLEAR DATA EVALUATION NEWSLETTER

NNDEN/33

This Newsletter has so far summarised evaluation activity only in the OECD area. Following discussions at the May 1982 Nuclear Reactor Data Centres meeting, a proposal was made to the NEA Nuclear Data Committee in September 1982 that the Newsletter should extend its geographical scope to include active evaluations in other IAEA Member countries, and its subject scope to cover work on nuclear model codes. For the first time, NNDEN/33 includes contributions from Bulgaria, Byelorussian SSR, GDR, Hungary, India, Israel and the IAEA Nuclear Data Section.

It should be noted that work in progress and future plans set out in this Newsletter may be changed without notice: the Newsletter is intended as an informal means of exchanging information between active evaluators, and should neither be quoted as a reference in publications nor be listed in any abstract journal.

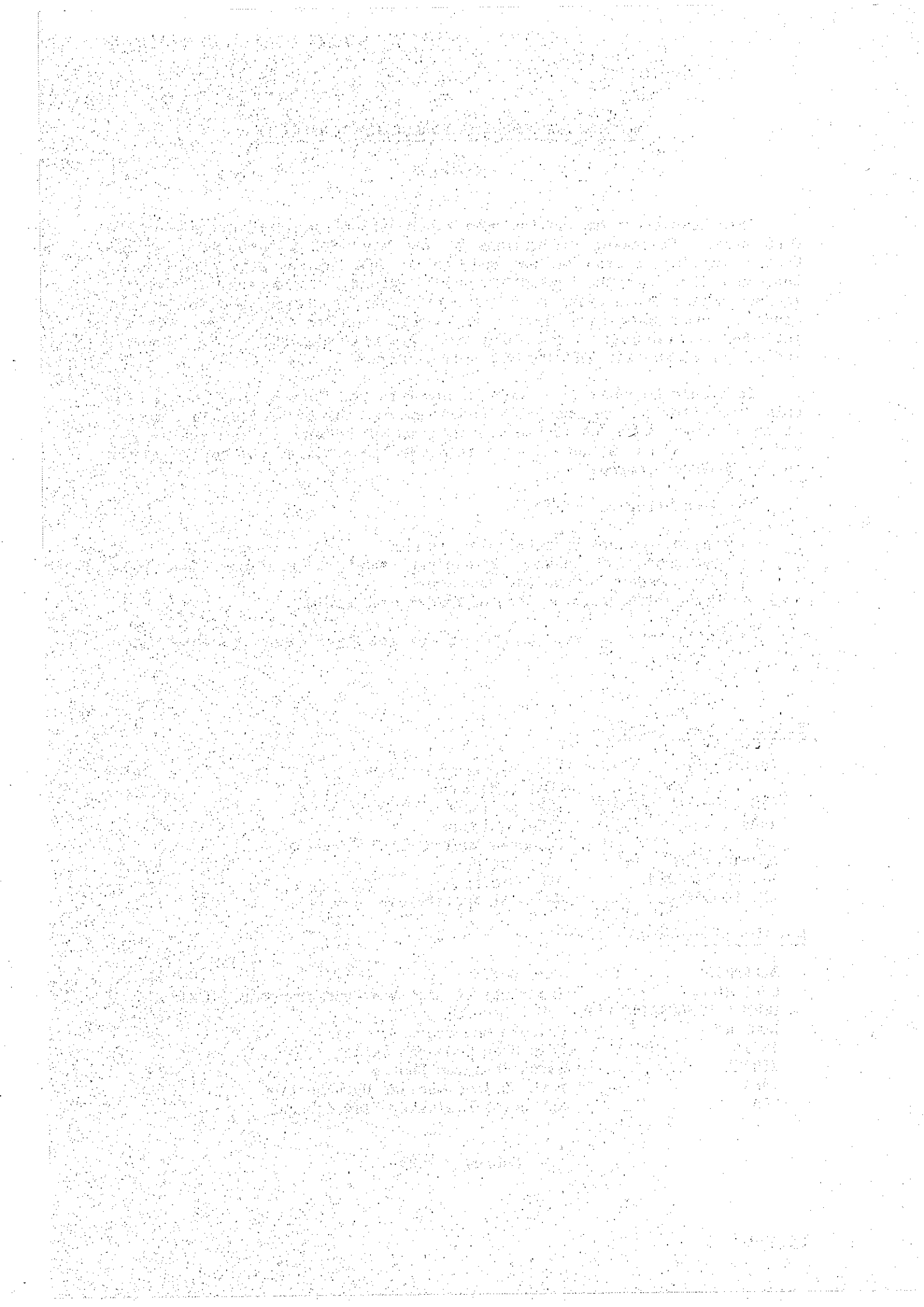
The Newsletter reports:

1. Evaluation work on particular nuclides
2. Development of codes for nuclear model calculations, and other codes needed for nuclear data work
3. Publications relevant to the neutron data field.

Contributions on evaluation activities have been received from:

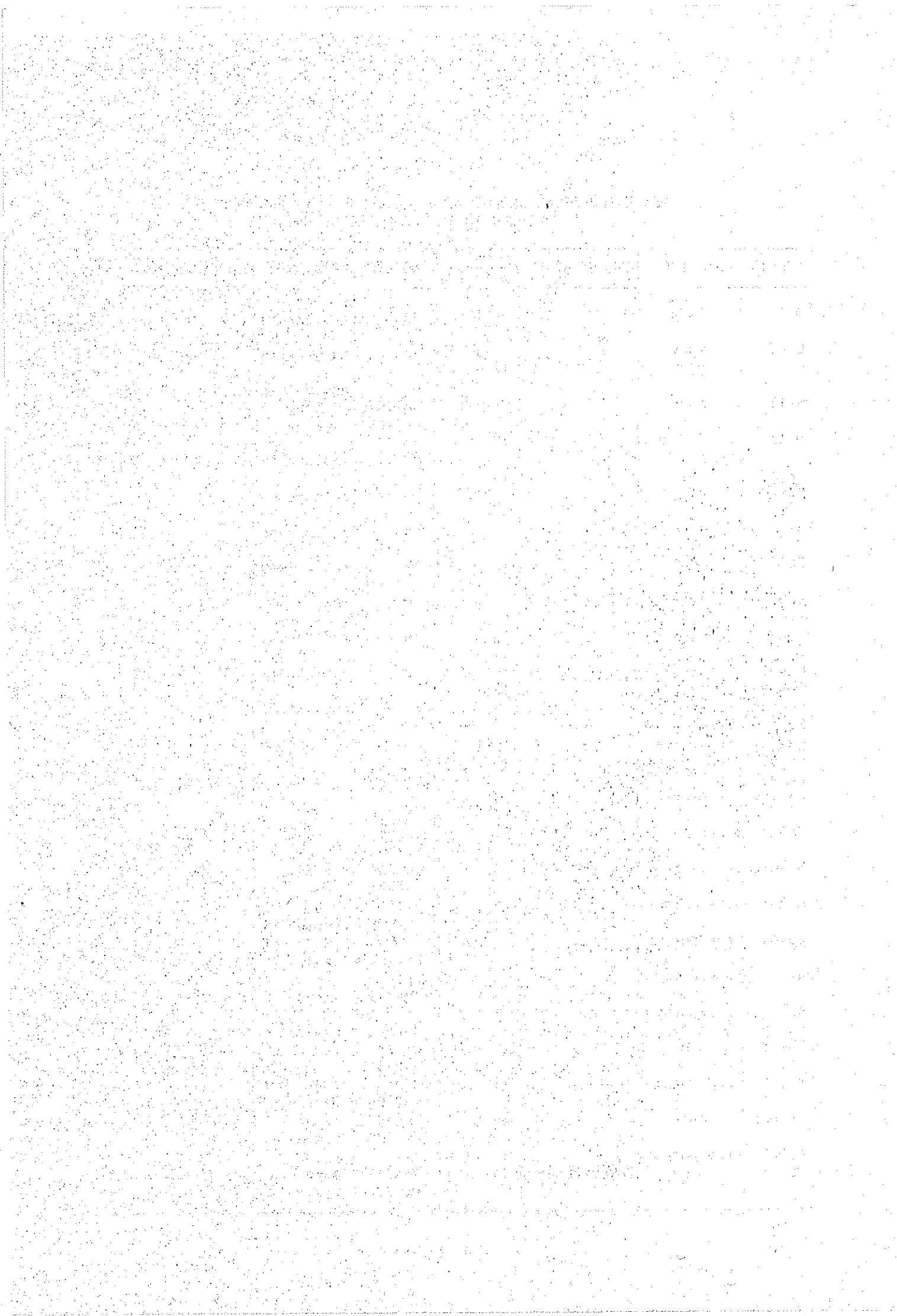
		<u>Page</u>
<u>Existing contributors</u>		
FRANCE	CEN, Bruyères-le-Chatel	1
	CEN, Cadarache	3
FED. REP. OF GERMANY	KFK, Karlsruhe	5
ITALY	ENEA, Bologna	8
JAPAN	Japanese Nuclear Data Committee	11
NETHERLANDS	ECN, Petten	13
UNITED KINGDOM	AEE, Winfrith	14
UNITED STATES	National Nuclear Data Center	17
<u>New contributors</u>		
BULGARIA	INR, Sofia	21
BYELORUSSIA	Institute of Heat and Mass Transfer, Minsk	22
GERMAN DEMOCRATIC REP.	T.U., Dresden	23
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IAEA	Work at IAEA Nuclear Data Section	28
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- February 1983 -

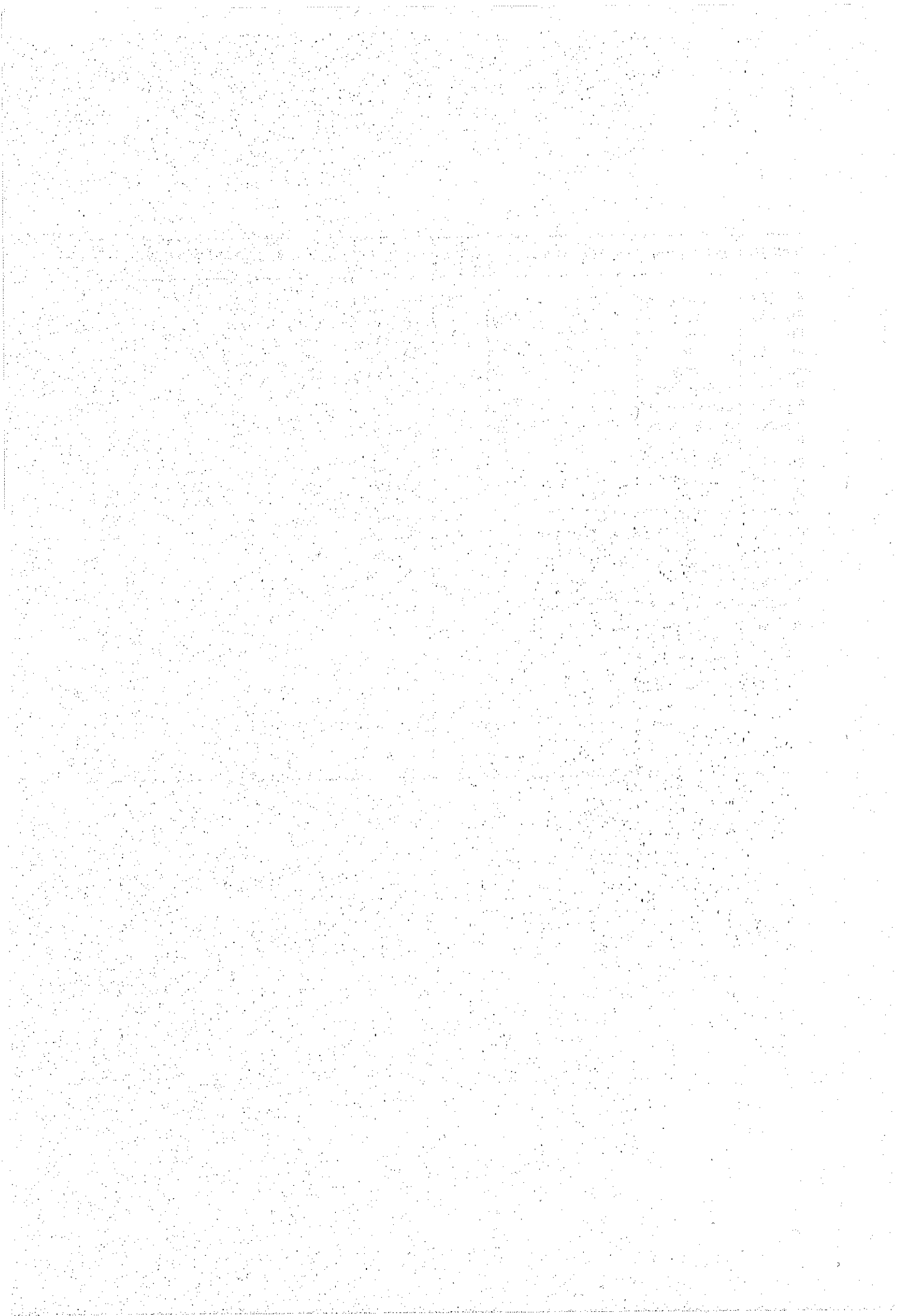


1. NEW EVALUATIONS RECENTLY COMPLETED A), IN PROGRESS B), OR
 PLANNED IN THE NEAR FUTURE C)

NUCLIDE	DATA TYPE	ENERGY RANGE	PAGE			NUCLIDE	DATA TYPE	ENERGY RANGE	PAGE		
			A	B	C				A	B	C
D-2	many			12		Mo	res.params		11		
Li-6	many			19		Pd	res.params		11		
Li-7	many		19			Ag	res.params		11		
B-10	many			19		Ag-107	many		19		
O-16	(covariance)		19			Ag-109	many		19		
Na-22	many		13			Cd	res.params		11		
Na-22	res.params			13		Sn-112	many		13		
Si	many		23			Sb	res.params		11		
Ca	many		19			Xe	res.params		11		
V-51	many	10 ⁻⁵ eV-20MeV	11			Cs	res.params		11		
Cr	(revision)		19			Ba	res.params		11		
Fe-57	many		19			La	res.params		11		
Fe-58	many		19			Pr	res.params		11		
Fe-nat	many		19			Nd	res.params		11		
Fe-54	res.params			15							
Fe-56	res.params			15							
Fe-57	res.params		15								
Fe-nat		KeV	21			Tm-169	many	10 ⁻⁵ eV-20MeV		2	
Fe	many		23								
Co-59	(covariance)		19			W-182	many		19		
Ni-nat	many	≤500keV	3			W-183	many		19		
U-233	res.params		26			W-184	many		19		
Zu-64	res.params			13		W-186	many		19		
Kr	res.params		11			W-nat	many		19		
Rb	res.params		11			Pb-nat	(revision)		19		
Rb-85	many		19			Bi-209	many	10 ⁻⁵ eV-20MeV	1		
Rb-87	many		19			Th-232	many		19		
Y	res.params		11			U-233	many		19		
Zr-nat	many		19			U-238	(n,2n)	6-19 MeV	24		
Nb	res.params		11			U-235				22	
Nb-93	many	20keV-20MeV	23			U-238	(covariance)		20		
						U-238	(n,p),(n,n')			6	
						U-235	many	MeV		4	
						U-238	many	MeV		4	
						Np-237	many.n2n	5-16 MeV	4		
						Np-237	res.params		19		



NUCLIDE	DATA TYPE	ENERGY RANGE	PAGE			NUCLIDE	DATA TYPE	ENERGY RANGE	PAGE		
			A	B	C				A	B	C
Pu-242	many				27						
Pu-239	many		22			Am-241	many			6	
Pu-240	many		22			Am-241m	many			6	
Pu-241	many		22			Am-243	many			6	
Pu-242	many		22			Am-243	many			15	
Pu-239	res.params		21			Am-243	(n,p)			20	
Pu-239	(covariance)		20								
Pu-240	(covariance)		20			Cm-244	many			6	
Pu-241	(covariance)		20			Cm-247	many	10^{-5} eV-15MeV		8	
Pu-239	(revision)			19		Cm-248	many	10^{-5} eV-15MeV			10
Pu-239	many	MeV		19		Cm-246	many	<20MeV			12
Pu-242	many	MeV		19		Cm-247	many	<20MeV			12
Pu-239	many	fast		2		Cm-244	many			27	
Pu-238	many	0.6-5.0 MeV	3			Cm-246	many			27	
Pu-238	many	<50keV		4		Cm-248	many				27
Pu-239	many	MeV		4							
Pu-240	many	<50 keV			4	F.P.	res.params				11
Pu-238	many	10^{-5} eV-14MeV	4								
Pu-240	many	50kev-16MeV			4						



Service de Physique Neutronique et Nucléaire
Centre d'Etudes de Bruyères-le-Châtel
France

Names : O. BERSILLON, M. COLLIN, J.P. DELAROCHE, Ch. LAGRANGE, R. PERRIER,
C. PHILIS, J. SALVY, N. VERGES .

Adress : Service de Physique Neutronique et Nucléaire
Centre d'Etudes de Bruyères-le-Châtel
B.P. n° 561, 92542 Montrouge Cedex, France

- Work recently completed and publications

- Ch. LAGRANGE, "Results of coupled channel calculations for the neutron cross sections of a set of Actinide nuclei", Report NEANDC (E) 228 "L", INDC (FR) 56/L (August 82) .

- J.P. DELAROCHE, "Direct interaction of fast neutrons scattered from the β and γ - band head levels of the even-A Tungsten isotopes" , Int. Conf. on Nuclear Data for Science and Technology, Antwerp (Sept 82) .

- O. BERSILLON, B. CAPUT, C.A. PHILIS, "A new evaluation of neutron data for the ^{209}Bi between 10^{-5} eV and 20 MeV" , Int. Conf. Antwerp (Sept 82) .

- P.G. YOUNG⁽¹⁾, E.D. ARTHUR⁽¹⁾, C. PHILIS, P. NAGEL⁽²⁾, M. COLLIN,
"Analysis of n + ^{165}Ho and ^{169}Tm reactions", Int. Conf. Antwerp (Sept 82) .

- Work in progress

- Semi-microscopic calculations of inelastic neutron scattering from heavy deformed nuclei . Studied nuclei : ^{154}Sm , ^{232}Th , ^{238}U (Ch. LAGRANGE, M. GIROD) .
- Transformations of angular scattering probabilities between reference systems : survey and numerical analysis (O. BERSILLON, A. SCHETT⁽³⁾, B. CAPUT) .
- Coherent optical and statistical model calculations of neutron cross sections for Gd isotopes (J.P. DELAROCHE, Ch. LAGRANGE) .
- Calculation of neutron cross sections for some Pt isotopes (J.P. DELAROCHE) .
- Complete reevaluation of ^{169}Tm from 10^{-5} eV to 20 MeV (E.D. ARTHUR⁽¹⁾, M. COLLIN, D. GARDNER⁽⁴⁾, M. GARDNER⁽⁴⁾, P. NAGEL⁽²⁾, C. PHILIS, P.G. YOUNG⁽¹⁾) .
- Evaluation of ^{239}Pu fast neutron cross sections (E. GRYNTAKIS⁽³⁾, C. PHILIS, J. SALVY) .

(1) LANL (USA)

(2) OECD (Paris)

(3) Collaborateur Temporaire Etranger

(4) LLNL (USA)

CONTRIBUTION TO NNDEN-33

Section de Physique des Neutrons Rapides
Centre d'Etudes Nucléaires de CADARACHE

Names : H. DERRIEN, E. FORT, J-P. DOAT, P. LONG

Address : DRNR/SEDC/SPNR

Centre d'Etudes Nucléaires de Cadarache

Boîte Postale n° 1

13115 Saint Paul lez Durance (France)

Work recently completed :

- Evaluation of natural Ni cross-sections in thermal and resolved resonance regions (H. DERRIEN).
- Reevaluation of ^{238}Pu neutron cross-sections in the energy range 0.6 Mev to 5 Mev, taking into account the recent experimental results of H. KNITTER and C. BUDTZ-JORGENSEN. (H. DERRIEN).
- Improvement of SI2N code to calculate (n,xn) reaction cross sections (E. FORT).

Work in progress :

- Evaluation of ^{238}Pu neutron cross sections in thermal, resolved and unresolved resonance region (H. DERRIEN, P. LONG).
- Reevaluation of ^{235}U , ^{238}U , ^{239}Pu from (n, 2n) threshold to 16 MeV (E. FORT, J-P. DOAT).

Work planned for the near future :

- Evaluation of ^{240}Pu neutron cross-sections in the thermal, resolved and unresolved resonance regions (H. DERRIEN, P. LONG).
- Evaluation of ^{240}Pu from unresolved resonance region (O.M. calculations) to 16 MeV (E. FORT, J.P. DOAT).

Publications :

- Evaluation of the neutron cross-sections of ^{238}Pu in the energy range 10^{-5} ev to 14 MeV (H. DERRIEN)
Report INDC (FR) - 57/L
- Evaluation des sections efficaces neutroniques de ^{238}Pu de 10^{-5} ev à 14 MeV (H. DERRIEN)
Antwerp Conference (september 1982).
- Evaluation des sections efficaces neutroniques de ^{237}Np entre 5 MeV et 16 MeV. Etude particulière de la réaction (n, 2n) pour l'application aux calculs de production de ^{236}Pu (E. FORT, H. DERRIEN, P-P. DOAT)
Antwerp Conference (september 1982).

Contribution to NNEN-33

KFK KARLSRUHE

GERMANY

Names: A. Anzaldo, F.H. Fröhner, B. Goel, H. Jahn, B. Krieg
Address: Institut für Neutronenphysik und Reaktortechnik
Kernforschungszentrum Karlsruhe
Postfach 3640
D-7500 Karlsruhe, West Germany

Work recently completed

- The number-theoretical approach to level density theory was developed to the point where level density expressions can be derived in closed form especially from those independent-particle level schemes that exhibit a pronounced regularity, for instance equidistant levels or the three-dimensional harmonic oscillator states. The key step, inverse Mellin transform of the grand partition function, leads to expressions where all information on the independent-particle levels is contained in a Dirichlet series whose analytical properties can be exploited. Asymptotically one obtains also the smooth level density required for Strutinsky renormalisation of shell effects. These results were briefly reported in Ref. 1.
(A. M. Anzaldo Meneses)
- A rigorous Bayesian solution to the problem of level density estimation from resonance parameters was found for the practically important case of a Porter-Thomas distribution of reduced widths affected by an observation threshold with known energy dependence but unknown absolute height. This new result was presented in the context of a more general review in Ref. 2.
(F.H. Fröhner)
- The angular distribution of 14.6 MeV neutrons inelastically scattered from ^{56}Fe as calculated from the precompound master equation approach was compared to DWBA results originally obtained for the proton channel but applicable also to the neutron channel. The two distributions look quite different at small angles, the master equation results being apparently an average over the DWBA results. This possible relationship is briefly discussed in Ref. 3.
(H. Jahn)
- A critical review of the measured capture and fission resonance integrals of ^{241}Am , $^{242\text{m}}\text{Am}$, ^{243}Am and ^{244}Cm was performed. Further the KEDAK-4 data particularly those reported in Ref. 4 were validated by comparison of the results of the burnup calculations based on these data and radiochemical analysis of spent fuel for different thermal reactors and reported in Ref. 5.
(B. Goel, U. Fischer)

- The new version KEDAK-4 has been finalised and is being prepared for release.
(B. Goel, B. Krieg)
- Analysis of neutron cross sections involved in the production of ^{58}Co , ^{60}Co and ^{236}Pu in different reactors has been done and reported in Ref. 5.
(H.W. Wiese, U. Fischer, B. Goel)

Work in progress

- Documentation of KEDAK-4
(B. Goel, B. Krieg)
- Number-theoretical level density formulae.
(A. Anzaldo, H. Jahn)
- Comparative study of precompound reaction theories
(H. Jahn)
- Reevaluation of capture and inelastic scattering of ^{238}U in the unresolved resonance region.
(F.H. Fröhner, B. Goel)
- Comparison of the capture and fission rate for ^{241}Am and ^{243}Am measured in ZEBRA assemblies and those calculated with KEDAK-4 data.
(B. Goel, E. Wiegner)
- Evaluation of $d(t,n)\alpha$ cross section.
(B. Goel)

References

1. A.M. Anzaldo Meneses, "A New Approach to Calculate Nuclear Level Densities on the Basis of Recent Number Theoretical Developments", Proc. Int. Conf. on Nucl. Data for Science and Technology, Antwerp 1982 (in print)
2. F.H. Fröhner, "Review of Methods for Level Density Estimation from Resonance Parameters", Proc. Int. Conf. on Nucl. Data for Science and Technology, Antwerp 1982 (in print)
3. H. Jahn, "Intercomparison of Angular Distributions of Direct and Preequilibrium Types of Reaction Mechanisms", Proc. 3rd Int. Symposium on Neutron Induced Reactions, Smolenice 1982 (in print)
4. F.H. Fröhner, B. Goel, U. Fischer, H. Jahn, "Neutron Cross Section Evaluation for ^{241}Am , ^{242}mAm , ^{243}Am and ^{244}Cm ", Proc. Int. Conf. on Nucl. Data for Science and Technology, Antwerp 1982 (in print)
B. Goel, F.H. Fröhner, "Nuclear Data Evaluation for Fissile Nuclei", XIIth International Symposium on Nuclear Physics, Gaussig, Nov. 22 - 26, 1982

5. B. Goel, U. Fischer, "A Critical Review of Resonance Integrals and Post-irradiation Fuel Analyses for Important Isotopes of Am and Cm", Proc. Int. Conf. on Nucl. Data for Science and Technology, Antwerp 1982 (in print). For additional details of the method see U. Fischer, H.W. Wiese, "Verbesserung konsistenter Berechnung des nuklearen Inventars abgebrannter DWR-Brennstoffe auf der Basis von Zell-Abbrand-Verfahren mit KORIGEN", KfK 3014, (in print)
6. H.W. Wiese, U. Fischer, B. Goel, "Analysis of Neutron Cross Section for the Formation of ^{58}Co , ^{60}Co and ^{236}Pu in Both Thermal and Fast Reactors", Proc. Int. Conf. on Nucl. Data for Science and Technology, Antwerp 1982 (in print)

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Names: V. Benzi, C. Bonifazzi, F. Fabbri, G. Maino, T. Martinelli, E. Menapace,
M. Motta, G.C. Panini, G. Reffo, M. Vaccari, A. Ventura.

Publications

- 1) G. Maino and A. Ventura, "Symmetry Considerations on the Fission Isomer Spectra", Lett. Nuovo Cimento 34, 533 (1982).
- 2) G. Maino, E. Menapace and A. Ventura, "IBA Description of Collective States in Neodymium Isotopes", contr. paper to Int. Conf. on Nuclear Data for Science and Technology, Antwerp, 6-10 September 1982.
- 3) G. Maino, E. Menapace, M. Vaccari and A. Ventura, "Evaluation of ^{247}Cm Neutron Cross Sections from 10^{-5} eV to 15 MeV", report INDC(ITY)-9, (1982).
- 4) E. Menapace, G.C. Panini and M. Vaccari, "Recommended Evaluated Cross Sections of the Isotopes of Natural Gd", contribution to the Meeting of the Scientific Coordination Group of the Joint Evaluated File, Antwerp, Sept. 8, 1982.
- 5) E. Menapace, G.C. Panini and M. Vaccari: "Recommended Evaluated Data for Cm-242,243,245", contribution to the Meeting of the Scientific Coordination Group for the Joint Evaluated File, Antwerp, Sept. 8, 1982.

Work in progress

- *Neutron cross sections.* Actinides: the evaluation of ^{248}Cm cross sections in the energy range 10^{-5} eV - 15 MeV is in progress.
(G. Maino, E. Menapace, M. Vaccari, A. Ventura).

- *Nuclear structure of fission product nuclei:* low-lying collective states and electromagnetic transitions of even-even Neodymium isotopes are described within the framework of the Interacting Boson Approximation; partial results of this analysis have been presented at the Antwerp Conference /2/. The final results, referring to collective states of both parities below 2.5 MeV and E1-E2-E3 transitions will be published in a more extended paper.
(G. Maino, E. Menapace, A. Ventura).

Work recently completed

- *Neutron cross sections*: total, capture, elastic, inelastic, (n,2n), first- and second-chance fission cross sections for ^{247}Cm have been calculated in the energy range 10^{-5} eV - 15 MeV. The results are presented in ref./3/.
(G. Maino, E. Menapace, M. Vaccari, A. Ventura).
- *Nuclear structure of Actinides*: spectroscopic properties of $^{236-238}\text{U}$ in the second well of the fission barrier have been analyzed in the frame of the Interacting Boson Model. Results are presented in ref. /1/.
(G. Maino, A. Ventura).
FP data: the intercomparison of recent evaluations of Gd isotopes and the forthcoming recommendations were completed and documented.
(E. Menapace, G.C. Panini, M. Vaccari).
- *Processing and conversion codes*: the KTOE-3 code for the translation of data from KEDAK to ENDF/B format has been completed. Test cases has been performed over some typical materials with successful results. The code treats properly the following:
 - a) ENDF/B-IV or V version data can be obtained;
 - b) translated file may optionally include resonance data;
 - c) thresholds value are exactly computed;
 - d) Legendre expansion coefficients are used to define angular distributions;
 - e) exact translation of secondary energy distribution laws when given in the file is performed; when not, they are computed accordingly to the MIGROS-3 code specifications. A final report describing the code features and use is being written.
(C. Nordborg, NEA-DB, G.C. Panini).

Contribution to Neutron Nuclear Data Evaluation Newsletter-33

Japanese Nuclear Data Committee
(Nuclear Data Center, JAERI)

Work Recently Completed and Publications:

- (i) Clustering Effects on Neutron Elastic Scattering from Lithium Isotopes
Seichi KOMODA and Tamotsu SEKIYA

Atomkernenergie/Kerntechnik, vol. 40, no. 2, (1982) pp. 119 - 124

In our model we take into account the two-cluster configuration of lithium nuclides. Its validity is tested by analyzing the differential cross section data for neutron elastic scattering from ${}^6\text{Li}$ and ${}^7\text{Li}$ at bombarding energies between 7 and 14 MeV. It is found that the model gives an adequate description of neutron elastic scattering at forward scattering angles. It is concluded that quasi-free neutron-cluster scattering contributions are significant even at the low energies investigated.

- (ii) Clustering Effects on Neutron Elastic Scattering from Boron Isotopes
Seichi KOMODA and Tamotsu SEKIYA

(To be submitted in Atomkernenergie/Kerntechnik)

The model developed in earlier papers is applied to boron isotopes and the differential cross section data for neutron elastic scattering from ${}^{10}\text{B}$ and ${}^{11}\text{B}$ are reproduced at forward scattering angles at bombarding energies between 7 and 14 MeV. The magnitude of the discrepancy between the theoretical and experimental angular distributions at backward scattering angles decreases smoothly with the bombarding energy as it did in the previous analyses on lithium isotopes.

- (iii) Evaluation of Neutron Cross Sections for Vanadium
Shigeya TANAKA

(JAERI-M 82-151 (1982))

Comprehensive neutron nuclear data for vanadium have been evaluated from thermal region to 20 MeV, and the results are to be filed in the ENDF/B format as an elemental component in Japanese Evaluated Nuclear Data Library-Version 2 (JENDL-2). The data base, the evaluation procedure and judgement, and the final results are described. The results include the neutron total cross sections, all significant partial cross sections of neutron induced reactions and the resonance parameters of vanadium. Particular attention has been paid to higher energy processes having an impact on FBR and CTR.

Work in Progress:

- (i) Systematics of the optical potential parameters, level density parameters and radiative widths of FP nuclides have been studied. A report of this study was submitted to the Journal of Nucl. Sci. Tech. Evaluations of the resonance parameters for Kr, Rb, Y, Nb, Mo, Pd, Ag, Cd, Sb, Xe, Cs, Ba, La, Pr and Nd isotopes have been finished, but for the other nuclides of 80 FPs, evaluation work is now in progress. Smooth cross sections of Nb, Mo, Pd, La, Pr and Nd isotopes were calculated using optical and statistical models.

(from M. Kawai, NAIG)

(ii) Evaluation of neutron nuclear data for ^2H is in final stage. The angular distributions for the elastic scattering and the double differential cross sections for the (n,2n) reaction have been calculated on the basis of the Faddeev equation with s-wave separable potentials.

(from K. Shibata, JAERI)

(iii) Evaluation of neutron nuclear data for ^{246}Cm and ^{247}Cm is in progress below 20 MeV.

(from Y. Kikuchi, JAERI)

S. Igarasi
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Tokai Research Establishment
Japan Atomic Energy Research Institute
Tokai-mura, Naka-gun, Ibaraki-ken 319-11
Japan

December 20, 1982

NEUTRON NUCLEAR DATA EVALUATION NEWSLETTER-33

ECN-Petten - The Netherlands

1. Names

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2. Recent publications and preprints (available upon request)

- |1| H. Gruppelaar, Status of recent fast capture cross section evaluations for important fission product nuclides, NEANDC/NEACRP Specialists' Mtg. on Fast-neutron capture cross sections, Argonne, 20-23 April 1982, ECN 82-045.
- |2| H. Gruppelaar and H.A.J. van der Kamp, Evaluation of activation cross sections of corrosion products, cover-gas nuclides and other nuclides in the primary cooling circuit of a fast power reactor, Contr. to the Int. Conf. on Nuclear Data for Science and Technology, Antwerp, Sept. 1982, ECN-82-117.
- |3| H. Gruppelaar, C. Costa, D. Nierop and J.M. Akkermans, Calculation and processing of continuum particle-emission spectra and angular distributions, *ibid.*, ECN-82-114.
- |4| J.M. Akkermans, A random walk in the land of precompound decay, thesis Groningen University, ECN-121 (1982).
- |5| C. Costa, H. Gruppelaar and J.M. Akkermans, Angle-energy correlated model of preequilibrium angular distributions, submitted for publication in *Phys. Rev. C*; ECN-82-172.
- |6| C. Costa, H. Gruppelaar and J.M. Akkermans, Energy dependence of preequilibrium angular distributions, to be published.

3. Work recently completed

- . Evaluation of neutron cross sections for ^{22}Na and ^{112}Sn |2|.
- . Angle-energy correlated model of preequilibrium angular distributions |4-6|.

4. Work in progress

- . Revision of ^{22}Na and ^{64}Zn neutron cross sections, using new experimental information in the resolved-resonance range.

5. Work planned for the near future

- . Continuation of efforts in evaluation and adjustment of capture cross sections for about 15 fission-product nuclides (RCN-3 evaluation; JEF).
- . Evaluation of neutron cross sections for structural materials (JEF).
- . Evaluation of neutron cross sections for fusion-design studies.

6. Computer codes

Improvements to the PRANG code system for the calculation of multi-particle precompound and compound continuum emission have been achieved, see Refs. |4,5|.

NUCLEAR DATA EVALUATION NEWSLETTER

NO 33

The United Kingdom

PERSONNEL

The following graduate personnel are currently working on nuclear data evaluation:-

UK Atomic Energy Authority

- i) Winfrith, Reactor Physics Division - M F James - R W Smith - C J Dean

Address: Building B21, Atomic Energy Establishment, Winfrith, Dorchester, Dorset. Telephone Dorchester 3111, Telex No 41231

Winfrith Technology Branch - A L Nichols

Address: Building A50, Atomic Energy Research Establishment, Winfrith, Dorchester, Dorset. Telephone Dorchester 3111, Telex No 41231

- ii) Harwell, Electron Accelerator Group (Building 418)

J E Lynn - M C Moxon - M G Sowerby - B H Patrick

Address: Atomic Energy Research Establishment, Harwell, Oxfordshire, OX11 0RA. Telephone Abingdon 24141; Telex No 83135

Harwell Chemistry Division (Building 220)

Katherine M Glover - M King - J G Cuninghame

Address: Atomic Energy Establishment, Harwell, Oxfordshire, OX11 0RA. Telephone Abingdon 24141; Telex No 83135

- iii) Central Electricity Generating Board

Berkeley Nuclear Laboratory - B S J Davies - A Tobias

Address: Berkeley Nuclear Laboratories, CEGB Berkeley, Gloucestershire, GL13 9PB. Telephone Berkeley 451.

- iv) British Nuclear Fuels Limited

Windscale and Calder Works - V Barnes

Address: Windscale and Calder Works, Sellafield, Seascale, Cumbria. Telephone Seascale 333.

2 WORK COMPLETED

(a) Resonance parameter processing code - SIGAR7

Following the results of the intercomparison of SIGMA1 and MLCS with SIGAR7 (see Issue 32) and the use of SIGAR7 with the Winfrith resonance parameter evaluation of Fe58 several important modifications have been made to SIGAR7 during the last nine months. These are:

- (i) The automatic provision of extra energy mesh points, where necessary, to improve the cubic spline fit when there are very narrow resonances. Negative cross sections were occurring for certain narrow resonances when using the cubic spline option with the earlier point selection procedure.
- (ii) For the Reich Moore option modifications have been made to allow for the energy shift in the peaks of narrow non s-wave resonances away from the eigenvalues. (Very important for the case of the Fe58 resonance parameters). Two options are available, either the eigen-values or the resonance peak energies can be supplied as input. A paper was presented at the 1982 Antwerp Conference.
- (iii) An improved treatment for calculating the energies of the minima and maxima of s-wave resonances (allowing for distant resonances).
- (iv) The program now uses double precision arithmetic throughout.

This program of developments has now been satisfactorily concluded. The code and its User Guide will be sent to the NEA Data Bank shortly.

(b) Am243 evaluation

Versions of an Am243 evaluation, previously produced as UKNDL file DFN 1010, have been prepared in ENDF/B-4 and B-5 formats. These are not simply pointwise translations but follow the recommended ENDF/B format procedures and contain resonance parameters. The evaluations (both Material No 9530) have been sent to the NEA Databank.

(c) Heavy element decay data

A report (AEEW-R1407) describing the contents of UKHEDD-1, a library of evaluated heavy element decay data for the UK Chemical Nuclear Data Committee (UKCNDC) has undergone peer revision and is in the process of reproduction at AEE Winfrith.

3 WORK IN PROGRESS

(a) Resonance parameter evaluation of the isotopes of iron

The work on the resonance parameter evaluation of the isotopes of iron (Fe54, Fe56 and Fe57) is continuing.

(b) Activation Product Decay Data

Evaluation efforts in 1982 have concentrated on the development of an activation products decay data library (UKPADD-2) in ENDF/B-5 format for reactor applications. This work constitutes an updating of the present UKCNDIC activation product decay data library (UKPADD-1) and will include decay data for approximately 410 nuclides (165 will be taken from UKFPDD-2 and a further 17 from UKHEDD-1, leaving the decay scheme data for 228 nuclides to be evaluated.)

This work has begun with the assessment of decay data for 50 nuclides from 3-H to 49-Ca.

John Rowlands

Reactor Physics Division
Building B21
AEE Winfrith

January, 1983

U.S.A. Contribution to NNEN - 33
Via the National Nuclear Data Center

Recent Publications

ANL/NDM-58 July 1981.

"Review of Measurement Techniques for the Neutron Radiative Capture Process", W.P. Poenitz.

ANL/NDM-64 January 1982.

"The Fission Fragment Angular Distributions and Total Kinetic Energies for $^{235}\text{U}(n,f)$ from 0.18 to 8.83 MeV", J.W. Meadows, C. Budtz-Jorgensen.

ANL/NDM-65 March 1982.

"Note on the Elastic Scattering of Few MeV Neutron from Elemental Calcium", A.B. Smith and P.T. Guenther.

ANL/NDM-66 May 1982.

"Fast Neutron Scattering Cross Sections of Elemental Silver", A.B. Smith and P.T. Guenther.

ANL/NDM-67 MAY 1982

"Non Evaluation Applications for Covariance Matrices", D.L. Smith.

ANL/NDM-68 July 1982

"Fast Neutron Total and Scattering Cross Sections of ^{103}Rh ", A.B. Smith, P.T. Guenther, and J.F. Whalen.

ANL/NDM-70 July 1982

"Fast Neutron Total and Scattering Cross Sections of Niobium", A.B. Smith, P.T. Guenther, and J.F. Whalen.

ANL/NDM-71 June 1982

"Fast Neutron Total and Scattering Cross Sections of Elemental Palladium", A.B. Smith, P.T. Guenther, and J.F. Whalen.

ANL/NDM-73 July 1982

"Fast Neutron Elastic Scattering Cross Sections of Elemental Tin", C. Budtz-Jorgensen, P.T. Guenther, and A.B. Smith.

EPRI NP-2510, BNL-NCS-31451 (ENDF-328) July 1982

"Guidebook for the ENDF/B-V Nuclear Data Files", B.A. Magurno, R.R. Kinsey, and F.M. Scheffel.

LA-9285 (ENDF-321) April 1982

"New Fission Neutron Spectrum Representation of ENDF", D.G. Madland.

LA-9303-M VOL. I (ENDF-324) May 1982.

"The NJOY Nuclear Data Processing System, Volume 1. User's Manual", R.F. MacFarlane, D.W. Muir, and R.M. Boicourt.

U.S.A. Contribution to NNEN - 33
Via the National Nuclear Data Center

Continued

LA-UR-81-3497 November 1981.

"Use of the Statistical Model for the Calculation of Compound Nucleus Contributions to Inelastic Scattering on Actinide Nuclei", E.D. Arthur.

ORNL/TM-8185 (ENDF-323) August 1982

"User's Guide for BAYES: A General Purpose Computer Code for Fitting a Functional Form to Experimental Data", N.M. Larson.

ORNL/TM-8283 (ENDF-325) September 1982

"Summary of ENDF/B-V Evaluations for Carbon, Calcium, Iron, Copper, and Lead and ENDF/B-V Revision 2 for Calcium and Iron", C.Y. Fu.

EVALUATIONS RECENTLY COMPLETED OR IN PROGRESS

<u>Material</u>	<u>Laboratory</u>	<u>Status</u>
^6Li	Los Alamos	In progress - planned for ENDF/B-VI.
^7Li	Los Alamos	Completed - planned for Revision 2, ENDF/B-V
^{10}B	Los Alamos	In progress - Revision 2, ENDF/B-V
^{16}O	Los Alamos	Covariance file modified for Revision 2
Ca	ORNL	Completed - Revision 2, ENDF/B-V
Cr	BNL	Photon energy spectra modified for Revision 2
^{57}Fe , ^{58}Fe , Fe	ORNL	Completed - Revision 2, ENDF/B-V
^{59}Co	BNL	Covariance file modified for Revision 2
$^{85,87}\text{Rb}$	BNL	Revision 2, ENDF/B-V
ISO, NAT $_{\text{Zr}}$	BNL	Completed - Revision 2, ENDF/B-V
$^{107,109}\text{Ag}$	BNL, HEDL	Revision 2, ENDF/B-V
$^{182-186}\text{W}$	Los Alamos	Completed - will be included in Revision 2, ENDF/B-V
Natural W	Los Alamos	Completed - Revision 2, ENDF/B-V
Natural Pb	ORNL	Photon production file modified for Revision 2
^{232}Th	ORNL	Completed - Revision 2, ENDF/B-V
^{233}U	Los Alamos	Completed - planned for Revision 2, ENDF/B-V
^{237}Np	HEDL	Resonance Parameter file modified for Revision 2
^{239}Pu	Los Alamos	Corrections in progress - Revision 2, ENDF/B-V
$^{239,242}\text{Pu}$	Los Alamos	New evaluation of MeV region in progress for ENDF/B-VI

EVALUATIONS RECENTLY COMPLETED OR IN PROGRESS

Continued

^{243}Am

HEDL

Capture Cross Section modified for Revision 2

Dosimetry

ORNL

Relating fourteen reactions by ratios is completed including covariances

^{238}U

^{239}Pu

^{240}Pu

^{241}Pu

ORNL

Covariance file modified for Revision 2

Norman E. Holden
National Nuclear Data Center
Brookhaven National Laboratory
Upton, New York 11973
December 1982

Institute of Nuclear Research and Nuclear Energy
Bulgarian Academy of Sciences

Names: N. Janeva, N. Kuyumdzhieva, A. Mateeva, S. Toshkov

Address: Institute of Nuclear Research and Nuclear Energy
Blvd. Lenin 72, 1184 Sofia, Bulgaria

Work recently completed:

- Multilevel parametrization of ^{239}Pu total and fission cross sections on the base of transmission and self-indication data analysis in resolved energy region, T. Bakalov, G. Ilchev, S. Toshkov, V. Ukraintzev, Tran Chan May, N. Janeva, submitted to Atomic Energy (Russ.);

- Analysis of ^{239}Pu transmission experimental data in the unresolved resonance region, T. Bakalov, A.A. Vankov, G. Ilchev, N. Kuyumdzhieva, Tran Chan May, S. Toshkov, V. Ukraintzev, N. Janeva - to be published as a preprint of JINR-Dubna. The average group resonance parameters up to 20 keV of ^{239}Pu are obtained from analysis of measurement of Ref.1;

- Analysis of iron neutron experimental data in the resonance region, N. Kuyumdzhieva, N. Janeva. The Monte Carlo simulation is used for calculation of neutron cross sections and transmission data. The method and programme are described in Ref. 2 and publication 1.

Publications:

Calculation of neutron transmission in the unresolved resonance region, N. Kuyumdzhieva, N. Janeva, Bulg. Nuclear Energy, No.17, 1982.

References:

1. T. Bakalov et al., Nucl. Cross Section Technology, Knoxville (1979), p.692.

2. N. Kuyumdzhieva, N. Janeva, Nuclear Constants 3 (42), 1981.

BYELORUSSIAN S.S.R.

Names: V.A. Konshin et al.

Address: Institute of Heat and Mass Transfer
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Minsk

Work recently completed:

Evaluations for

<u>Nuclide</u>	<u>MAT-Nr.</u>	<u>Reference</u>
Pu-239	INDL-9421 Rev. 2	INDC(CCP)-166
Pu-240	INDL-9431 Rev. 1	INDC(CCP) to be publ.
Pu-241	INDL-9440 Rev. 0	INDC(CCP)-142
Pu-242	INDL-9450 Rev. 2	INDC(CCP)-150

Work in progress

Evaluation of U-235.
Further improvements to Pu evaluations.

GERMAN DEMOCRATIC REPUBLIC

Names: D. Hermsdorf, D. Seeliger et al.

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Work recently completed or in progress:

1. Evaluation for Nb-93 in the energy-range from 20 keV to 20 MeV, published in Kernenergie 20, 166 (1977). Updated in 1982. Available as INDL-4110 Rev. 1. Further revision is in progress.

2. In cooperation with F.E.I. Obninsk:

Evaluation for Fe, preliminary publication in Jadernye Konstanty 1 (36) p. 65 (1980). Available as SOKRATOR-2012 and as INDL-2640.

3. Evaluation for Si, to be published as INDC(GDR)-20 and INDC(GDR)-22. Available as SOKRATOR-2015 and INDL-1415 (in preparation).

INSTITUTE OF EXPERIMENTAL PHYSICS, KOSSUTH LAJOS UNIVERSITY

DEBRECEN, HUNGARY

Names: P. Raics, S. Daróczy, S. Nagy, J. Csikai, (I.E.P., Debrecen)
N.V. Konilov, V.N. Vinogradov, E.V. Gay, N.S. Rabotnov,
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Work recently completed: Experimental results for the U-238 (n,2n) reaction were collected from the literature and evaluated. The normalization of the measured cross-sections was carried out using recent values for the cross-sections of standard monitor reactions as well as new nuclear decay data. The evaluated excitation function was fitted with a 3rd order polynomial near the threshold (from 6.169 to 6.550 MeV) and the Padé - approximation was used for the neutron energy range of 6.55 - 19.0 MeV.

Publications: N.V. Kornilov, V.N. Vinogradov, E.V. Gay, N.S. Rabotnov, O.A. Salnikov, P. Raics, S. Daróczy, S. Nagy, J. Csikai: "Otzenka secheniya reaktzii U-238(n,2n) ot poroga do 19 MeV", Vopr. At.N.Tech., Yadernye Konstanty 1(45) 33-41 (1982)*, and with the same authors "Evaluation of the excitation function of the U-238(n,2n)U-237 reaction for neutron energies from threshold to 19 MeV", presented in the International Conference on Nuclear Data for Science and Technology, 6-10 Sept. 1982, Antwerpen.

* English translation will be available as INDC-report

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DEBRECEN, HUNGARY

Names: Z.T. Bódy, F. Cserpák, J. Csikai, A. Demény,
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Work in progress: Values of (n,t) cross-sections were compiled and are to be evaluated for all isotopes and for energies from the threshold up to 20 MeV. Till now preliminary results have been presented in two conferences for $Z \geq 10$ and energies around 14 MeV.

Publications:

1. Z.T. Bódy, F. Cserpák, J. Csikai, S. Sudár, K. Mihály:
Measurement and evaluation of (n,t) cross-sections, presented in the International Conference on Nuclear Data for Science and Technology, 6-10 Sept. 1982, Antwerpen.
2. Z.T. Bódy, K. Mihály: Compilation of (n,t) cross-sections, presented in the XII. International Symposium on Nuclear Physics - Heavy Ion Collisions and Nuclear Fission - 22-26 Nov. 1982, Gaussig near Dresden. (It will appear in ZfK Reports).

REACTOR RESEARCH CENTRE KALPAKKAM, INDIA

Names: S. Ganesan, V. Gopalakrishnan, M.L. Sharma and
M.M. Ramanadhan

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Kalpakkam 603 102
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Work recently completed

- Using codes developed at Kalpakkam, unresolved and resolved resonance parameters were evaluated for U-233 and documented (Ref. 1)
- A summary of the sensitivity studies performed at Kalpakkam to investigate the effects of data evaluation and processing in the unresolved resonance range on prediction of Doppler effect in fast reactor systems was made (Ref. 2)
- The reported measured values of self shielding factors were compared with values of self shielding factors calculated by two different methods (Ref. 3)

Work in progress:

- Generation and validation of multigroup cross section set for use in fast reactor calculations. Further improvements in the nuclear data processing code RAMBHA,

References

1. S. Ganesan and M.L. Sharma, "Evaluation of Resonance Parameters in Resolved and Unresolved Resonance Regions for ^{233}U ", RRC-43; INDC(IND)-28/GJ, IAEA, Vienna (1981)
2. S. Ganesan, "On the Need for Changing the ENDF/B Convention for the Representation of Cross Sections in the Unresolved Resonance Region of Fertile and Fissile Nuclei" Ann. Nucl. Energy 9, 481-487 (1982)
3. S. Ganesan, V. Gopalakrishnan and M.M. Ramanadhan in Proc. of Int. Conf on Nuclear Data for Science and Technology, Antwerp, Belgium, 6-10 Sept. 1982 (To be published)

SOREQ NUCLEAR RESEARCH CENTER

Names: M. Caner, Y. Bartal, S. Yiftah

Address: Department of Theoretical Physics & Applied Mathematics
Soreq Nuclear Research Centre
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Israel

Work recently completed:

Caner, M., and Yiftah S., "Curium-244 neutron data evaluation",
IA-1353 (1979).

Caner, M., Bartal, Y., and Yiftah, S., "Curium-246 neutron data evaluation"
IA-1358 (1980).

Caner, M., "Area analysis of underdetermined neutron resonance data",
Ann. Nucl. Energy 7, 403 (1980)

Work in Progress

Curium-248 neutron data evaluation

Work planned for the near future

Plutonium-242 neutron data evaluation

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Names: H.D. Lemmel, D.E. Cullen, K. Okamoto,
V.G. Pronyaev, O. Schwerer

Work recently completed: 1982 version of INDL, the IAEA Evaluated Nuclear Data Library in ENDF/B-5 format. This consists of 3 parts:

1. INDL/V - various evaluations, documented in IAEA-NDS-31 Rev.2, with main emphasis on conversion of USSR evaluations into ENDF/B-5 format, including
 - BOSPOR-80, evaluation of 142 threshold reactions on 98 nuclides from threshold up to 20 MeV
 - SOKRATOR, complete evaluations up to 15 MeV for He-3, Cr, Ni, (dated around 1977), Nb-93 (rev. 1982).and others.
2. IRDF-82 - the International Reactor Dosimetry File, documented in IAEA-NDS-48 [$\sigma(E)$], and IAEA-NDS-41 [multigroup data], including 10 reactions (contributed by Austria, Poland, UK) in addition to the ENDF/B-5 dosimetry file Mod. 2 of August 1981.
3. INDL/A - actinides, documented in IAEA-NDS-12 Rev. 6, containing recent evaluations for 17 actinides contributed from 9 institutes within a coordinated research project.

This is supplemented by the

EXFOR-V file - documented in IAEA-NDS-34 Rev. 1, containing evaluations for which the ENDF/B format is not suitable. Example: evaluations for tissue materials in the energy range from 20 MeV to 60 MeV.

Work in progress: Improved checking, corrections and additions to INDL, preparation of 1983 issue. Coding of (n,2n) data for actinides evaluated at Obninsk, USSR.

IAEA Nuclear Data Section
P.O. Box 100, A-1400 Vienna, Austria
Tel; 2360-1710 Telex; 1-12645

Name: D.E. Cullen

Work recently completed:

Compared multigroup cross sections produced by 28 participants, using 10 different cross section processing codes. Discovered that none of these sets of cross sections agreed with our benchmark results on their first attempt; differences varied from 6-5000% (e.g. at 5000% one code would predict a cross section of a barn and the other 50 barns).

Publications:

"Verification of Nuclear Cross Section Processing Codes" by D.E. Cullen, W.L. Zijp and R.E. MacFarlane; proceedings of the Topical Meeting on Advances in Reactor Physics and Core Thermal Hydraulics, NUREG/CP-0034, Vol. 2 p. 1078, also report INDC(NDS)-134 (1982).

Work in progress:

A positive result of this project has been that based on our comparisons it has been relatively easy to locate and eliminate problem areas from codes and we are now at the point where a number of codes have now been improved to the point that they can produce results which agree with our benchmark results.

Work planned in the near future:

The initial round of comparisons only used cold (0 Kelvin), unshielded group averaged cross sections. The next round of comparisons will consider; Doppler broadening and shielding of cross sections and calculation of multigroup transfer matrices. At the end of March 1983 the IAEA will publish the results of the first round of comparisons and in particular will identify those codes which have passed our tests and obtained agreement with our benchmark results.

The NEA Joint Evaluated File Project

The first version of the Joint Evaluated File (JEF-1) now contains 275 isotopes or natural element files, for which there still remains some work to be done in calculating pointwise cross-section files (at 0°K) from resonance parameters. The status of the JEF-1 file, and plans for first stage benchmarking, were the main themes for discussion at the January 1983 meeting of the project's Scientific Coordination Group (SCG).

Since the last issue of NNEN, the project has been reviewed by the OECD Steering Committee for Nuclear Energy, and a three-year second phase agreed for 1983-1985. The administrative framework for the JEF project will continue to be provided by the Data Bank, and the division of work between the Data Bank and its member countries was agreed: file assembly and simple testing will continue to be carried out by NEA Data Bank, but while new evaluations and the more complex benchmarking work will be carried out in member countries.

All the JEF-1 files completed so far have been checked with the ENDF/BV format verification code CHECKER and the physics code FIZCON, while a comparison of the simple integral quantities derived from JEF-1 data (2200 m/s cross-sections, Maxwellian spectrum averages, resonance integrals, 14 MeV and fission spectrum average cross-sections) with those for other large evaluated data files gave acceptable results. It is hoped that the complete JEF-1 library will be ready for the first stage of benchmark testing at the end of April 1983.

Benchmark Testing of JEF-1

The question concerning the type of group-averaged cross section set to be used for the first stage of benchmark testing was extensively discussed at the SCG meeting. A proposal to use the 1/4 lethargy structure for the fast reactor and shielding benchmarks was accepted and some simple benchmarks were chosen for the NEA Data Bank to calculate. These would include calculations of infinite homogeneous media and simple spherical geometry systems such as GODIVA and JEZEBEL. The thermal reactor benchmark analysis programme would be decided upon at the next meeting of the Group, when the thermal scattering data had been selected.

The second phase of benchmark testing was only briefly discussed, but it was agreed that the national laboratories should already prepare for this phase.

DISTRIBUTION LIST FOR OECD COUNTRIES

This list will be expanded in future issues to include contributors and other evaluators from IAEA member states outside the OECD group of countries.

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