NNDEN/46

NEUTRON NUCLEAR DATA EVALUATION NEWSLETTER

NEA DATA BANK
BANQUE DE DONNÉES DE L'AEN

March 1993

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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 have been received from:

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B) IN PROGRESS
C) PLANNED IN THE NEAR FUTURE

NUCLIDE	DATA TYPE	ENERGY RANGE	PAGE		
			A	B	C
Li-7	(n,n′) (478 keV) ang. distrib.	14.9 MeV, 8 → 20 MeV	16		
C-12	many	0 → 10 GeV	37		
Mg-nat	many		16		
Si-nat	many		16		
Ar-39	many		24		
Sc	many		35		
V-51	energy and ang. distrib.		33		
Fe-54	many		24		
Fe-56	many		24		
Co	dosimetry cross sections	1 → 50 MeV			27
Co-59	many		24		
Co-60	(n,p)			26	
Ni-58	(n,p) to ^{58m}Co	5 → 12 MeV	22		
Ni-58	many		24		
Ni-58	energy and ang. distribs		33		
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Ni-60	(n,p) to $^{60m+g}Co$	5 → 12 MeV	22		
Ni-60	many		24		
Zr (elemental)	many			35	
Zr-90	(n,α), (n,p)	5.4 → 12.3 MeV	21		
Zr-91	(n,p)	5.4 → 12.3 MeV	21		
Zr-92	(n,p)	5.4 → 12.3 MeV	21		

NUCLIDE	DATA TYPE	ENERGY RANGE	PAGE		
			A	B	C
Zr-94	(n,α)	5.4 → 12.3 MeV	21		
Zr-96	(n,2n)	5.4 → 12.3 MeV	21		
Tc-99	many	thermal/ resolved-resonance range	28		
Ru-96	(n,p)	13.0 MeV → 16.6 MeV		30	
Ru-99	(n,p)	13.0 MeV → 16.6 MeV		30	
Ru-101	(n,p)	13.0 MeV → 16.6 MeV		30	
Ru-102	(n,p)	13.0 MeV → 16.6 MeV		30	
Ru-104	(n,p)	13.0 MeV → 16.6 MeV		30	
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Pd (isotopes)	elastic and inelastic scattering	low	28		
Pd (isotopes)	many			36	
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In-113	(n,n′), (n,2n)	2.1→2.9, 13.5→14.8 MeV	23		
I-129	many	thermal/ resolved-resonance range	28		
Sm-147	resonance parameters		12		
Sm-148	resonance parameters		12		
Eu-151	(n,2n)	8.7 → 10.7 MeV	20		
Gd-156	distrib. of radiative strength		28		
Gd-157	distrib. of radiative strength		28		
Gd-158	distrib. of radiative strength		28		
Tb-159	(n,2n)	8.7 → 10.7 MeV	20		
Hf-177	resonance neutron capture	resolved region		12	
Hf-178	resonance neutron capture	resolved region		12	
Hf-179	resonance neutron capture	resolved region		12	

NUCLIDE	DATA TYPE	ENERGY RANGE	PAGE		
			A	B	C
Hf-180	resonance neutron capture	resolved region		12	
Hf-181	resonance neutron capture	resolved region		12	
Au	dosimetry cross sections	1 → 50 MeV			27
Pb-208	many	< 1 GeV	25		
Pb-208	particle production and nucleus formation	20 → 1000 MeV	25		
Bi-209	many	< 1 GeV	25		
Bi-209	particle production and nucleus formation	20 → 1000 MeV	25		
Bi-209	photoreaction data			26	
Th-232	resonance self-shielding			12	
Th-232	(n,2n)	6→10.5, 13.5→14.8 MeV	18		
Th-232	(n,xn), (n,f)	< 22 MeV	18		
Pa-231	prompt neutron fission spectra		10		
Pa-232	prompt neutron fission spectra		10		
Pa-233	prompt neutron fission spectra		10		
U-232	prompt neutron fission spectra		10		
U-233	prompt neutron fission spectra		10		
U-233	JENDL-3 benchmark			26	
U-233	resolved resonance parameters	< 150 eV		26	
U-234	prompt neutron fission spectra		10		
U-235	JENDL-3 benchmark			26	
U-237	many	< 20 MeV			27
U-238	neutron scattering		10		
U-238	resonance parameters, radiative capture	0.465 → 200 keV	11		

NUCLIDE	DATA TYPE	ENERGY RANGE	PAGE		
			A	B	C
U-238	transmission and capture	resonance region	11		
U-238	resonance self-shielding			12	
U-238	many	10^{-5} eV → 20 MeV	15		
U-238	(n,2n)	6→10.5, 13.5→14.8 MeV	18		
U-238	(n,xn), (n,f)	< 22 MeV	18		
U-238	capture and inelastic scattering		25		
U-238	many	1 → 20 MeV	32		
Np-236	many	< 20 MeV			27
Np-237	(n,f), (n,γ)	30 keV → 20 MeV	15		
Np-237	many	10^{-5} eV → 20 MeV	15		
Np-237	(n,2n)	7 → 10 MeV	18		
Np-238	many	< 20 MeV			27
Pu-239	resonance parameters			12	
Pu-239	(n,tot)	1 → 500 keV	24		
Pu-239	JENDL-3 benchmark			26	
Pu-239	neutron transmission, fission cross section	1.0 keV → 2.5 keV		26	
Cm-242	fission data		10		
Cm-243	fission data		10		
Cm-244	fission data		10		
Cm-245	fission data		10		
Cm-246	fission data		10		
Cm-247	fission data		10		
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NUCLIDE	DATA TYPE	ENERGY RANGE	PAGE		
			A	B	C
Actinides	many			10	
Fissile nuclides	multilevel parameterization		11		
Fission products	$^{75}As \rightarrow ^{159}Tb$	$10^{-5} \rightarrow 20MeV$	24		
Fission products	many				29
CENPL	evaluated nuclear parameters			13	
EAF-3	evaluation and compilation		38		
EAF-4	evaluation and compilation			29	
EFF-2.2	evaluation and compilation		38		
EFF-2.3	evaluation and compilation			38	
ENDF/B-VI	DDX neutron emission cross section		25		
FENDL					29
JEF-1	Fission products		28		
JEF-2	Fission products		28		
JEF-2	DDX neutron emission cross section		25		
JENDL-3	DDX neutron emission cross section		25		
JENDL-3	gas production		25		
JENDL-3	fission product cross section		25		
JENDL-3	fusion neutronics benchmark		26		

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COMPILER: Maslov V.M.

I RECENT PUBLICATIONS AND REPORTS

L.A.Bakhanovich, A.B.Klepatskij, V.M.Maslov, G.B.Morogovskij, Yu.V.Porodzinskij, E.Sh.Sukhovitskij "Nuclear Data Evaluation for U-233", Nucl. Data for Sci. and Technol.,(Springer-Verlag) 1992, p.915.

A.B.Klepatskij, V.M.Maslov "Fast Neutron Nuclear Data: Pu-239 Reevaluation and Am Status", Nucl. Data for Sci. and Technol., (Springer-Verlag) 1992, p.881.

A.V.Ignatjuk, V.M.Maslov "Pairing Effects in Neutron Fission Cross Sections for Actinides", Nucl. Data for Sci. and Technol., (Springer-Verlag), 1992, p.153.

V.M.Maslov "Analysis of 232-Th (n,2n) Reaction Data", Annals of Nucl. Energy V.19,No.3, p.181, 1992.

V.M.Maslov "Curium Fission Cross Sections Analysis", accepted by Annals of Nucl. Energy, 1992.

A.V.Ignatjuk, V.M.Maslov "Fission Model for Cross Section Calculations" (invited), Int. Symp. on Nucl. Data Evaluation Methodology, 11-16 October, 1992, Brookhaven,N.Y.,USA.

V.M.Maslov "Neutron Data Evaluation for 233,232,231-Pa" Jadernye Constanty 1, 1992 (in Russian).

Yu.V.Porodzinskij,E.Sh.Sukhovitskij "Hexadecapole Modes within a Phenomenological Collective Model with Five Dynamical Variables" J. of Nucl. Phys. V.55, p.2368, 1992 (in Russian).

Yu.V.Porodzinskij, E.Sh.Sukhovitskij "Realistic Hamiltonian for Nucleon Scattering Analysis on Non-Axial Deformable Even Nuclei", submitted to the Int. Symp. on Nuclear Data Evaluation Methodology, 11-16 October,1992, Brookhaven, N.Y.,USA.

Yu.V.Porodzinskij,E.Sh.Sukhovitskij "Rotational-Vibrational States of Non-Axial Even-Even Deformable Nuclei in Collective Model with Five Dynamical Variables" Izvestia AN USSR, ser. Phys.,1992 (in press).

Yu.V.Porodzinskij,E.Sh.Sukhovitskij "Realistic Hamiltonian for Nucleon Scattering Analysis on Non-Axial Deformable Even Nuclei", abstracts of Int. Conf. on Nuclear Structure and Nuclear Reactions at Low and Intermediate Energies, 15-19 September 1992, Dubna, Russia.

A.V. Ignatjuk, V.M. Maslov "Dynamical Effects in U-235 Neutron-Induced Fission", abstracts of International Seminar on the Interactions of Neutrons with Nuclei, 14-17 April, 1992, Dubna, Russia.

II WORK RECENTLY COMPLETED

An analysis of fission data for Cm nuclei (A=242-248). The need to reevaluate the Cm neutron data is ascertained.

The beta- and gamma-soft rotator model is employed in multi-channel strong coupling approach for U-238 neutron scattering data analysis. It is shown that imaginary potential parameter should be essentially modified. Door-way-states manifestation in neutron-induced cross sections is interpreted.

Calculations and evaluations of prompt neutron fission spectra for 232-,233-,234-U and 231-,232-,233-Pa isotopes.

III WORK IN PROGRESS

The octupole deformations and vibrations incorporation into collective nuclear Hamiltonian of beta- and gamma-soft rotator is attempted to describe negative parity excited states. The obtained Hamiltonian is employed in coupled-channel calculations.

Consistent analysis of v(E) and prompt fission neutron spectra within Madland-Nix model for minor actinides.

Dynamical effects in intermediate energy neutron-induced fission of actinides. The cold nature of fission process is incorporated.

IY WORK PLANNED FOR FUTURE

Theoretical analysis and consistent calculations of v(E) for neutrons and gammas, neutron and gamma-ray spectra for actinides.

The optical potential for neutron energies up to 200 MeV.

A systematic dependence of measured neutron-induced fission cross sections of actinides on fissility in the region 60-200 MeV interpretation.

Continuing work on minor actinide neutron data evaluation.

V WORK ON CODES

See above items III,IV

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1.Recent Publications and Reports

A.A.Lukyanov, "Multilevel Parameterization of Fissile Nuclei Cross Sections", Symposium on Nuclear Data Evaluation Methodology, 12-16 Oct, 1992, Brookhaven National Laboratory, Upton, N.Y., USA - Invited Paper.

A.A.Lukyanov, M.N.Alami, N.Koyumdjieva, N.Janeva, "Modeling of Cross Sections in the Unresolved Energy Region", Int. Varna School, 14-19 Oct, Varna, 1991.

M.N.Alami, N.Janeva, A.A.Lukyanov, "Study of Characteristic Function in the Statistical R-matrix Theory" Bulg. J. Phys., 18, 1991.

M.N.Alami, N.Koyumdjieva, A.A.Lukyanov, N.Janeva, "Modeling of Cross Sections in the Unresolved Resonance Region", Nuclear Data for Science and Technology, S.M.Qaim(Ed.), Springer-Verlag, 1992, 968.

N.Janeva, N.Koyumdjieva, A.Lukyanov, "Neutron Cross Sections Modeling in the Unresolved Resonance Region", Symposium on Nuclear Data Evaluation Methodology, 12-16 Oct, 1992, Brookhaven National Laboratory, Upton, N.Y., USA.

G.Georgiev, Yu.V.Grigorjev, Yu.S.Zamjatnin, B.Ivanov, V.N.Koshceev, G.N.Manturov, G.V.Muradyan, I.Sirakov, V.V.Sinitsa, N.Janeva, "Measurement and Analysis of Resonance Structure Characteristics of ^{238}U Total and Radiative Capture Cross Sections in the Energy Interval 0.465-200 keV", Yad. Konst., 4, 1991, 26-39.

N.Janeva, Yu.V.Grigorjev, V.N.Koshceev, G.N.Manturov, V.V.Sinitsa, G.Georgiev, B.Ivanov, I.Sirakov, Yu.S.Zamjatnin, G.V.Muradyan, "Measurements and Analysis of Transmission and Capture Self-indication of ^{238}U in the Resonance Region", Proc. Int. Conf. on Nuclear Data for Science and Technology,

Jülich, 1991.

G.Georgiev, Yu.V.Grigorjev, Yu.S.Zamjatnin, B.Ivanov, G.V.Muradyan, L.B.Pikelner, I.Sirakov, N.Janeva, "On the Study of Neutron Resonances of ^{147}Sm", Proc. Int. Conf. on Nuclear Data for Science and Technology, Jülich, 1991.

N.Janeva, S.Toshkov, G.V.Muradyan, Yu.V.Grigorjev, G.Georgiev, I.Sirakov, V.G.Tishin, Yu.S.Zamjatnin, "A Set-up for Precise Measurement of Resonance Neutron Capture by Self-indication", Nucl. Instr. and Meth. in Physics Research, A313 (1992) 266.

2.Work recently completed:

N.Koyumdjieva, A.A.Lukyanov, N.Janeva, "An Investigation of the Resonance Parameters Fluctuations on the Base of the Characteristic Function".

N.Koyumdjieva and N.Janeva, "Calculation of the Averaged Cross Sections and their Functionals by Using of the Periodicity of the Resonance Structure".

N.Janeva et al.,"Spin Identification of Resonance Levels by Using of the γ-Multiplicity Spectrum".

G.Georgiev,...T.Madjarski, N.Janeva, "Determination of ^{147}Sm and ^{148}Sm Resonance Parameters".

3.Work in progress:

Testing the self consistency of ^{239}Pu resonance parameters on the base of S-matrix unitarity property.

Measurements of resonance neutrons capture for Hf - 177,178,179,180,181 in the resolved region.

Investigations of resonance self-shielding in ^{238}U and ^{232}Th on the base of the characteristic function presentation.

A NUCLEAR MODEL PARAMETERS LIBRARY AT CNDC

Su Zongdi Ge Zhigang Zhou Chunmei Ma Lizhen

CHINESE NUCLEAR DATA CENTRE,CIAE

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As we know, the nuclear basic physical constants and model parameters are very important for the nuclear data calculations and evaluations. The confidence of the calculated results depends on not only the model theory but also the reliability of the adopted parameters, but users have some trouble in looking for the needed parameters. Based on above considering, Chinese Evaluated Nuclear Parameters Library(CENPL) is being built at Chinese Nuclear Data Centre. CENPL contains the characteristic constants of nuclear ground state and the most of nuclear model parameters for the nuclear reaction calculations and consists of six files as follows:

1. Atomic masses and characteristic constants for nuclear ground state.

This file contains atomic masses, spin and parity of ground state, half–life or abundance and binding energy etc.,and consists of 4800 nuclei ranging from Z=0, A=1 to Z=122, A=318.

2. Discrete level schemes

The nuclear discrete levels are based on the Evaluated Nuclear Structure Data File of BNL. We are writing a code to retrieve the discrete levels and their gamma branching ratios of single nucleus or all possible residual nuclei in a studied neutron induced reaction. The relevant information, such as the energy, spin, parity, etc. of the discrete levels are included.

3. Giant resonance parameters for gamma–ray strength functions

The file of giant dipole resonance parameters, which mainly are from data complied by Dietrich and Berman, (first edition), has been finished and the relevant retrieval code system (second edition) has been wroten to retrieve the giant dipole resonance parameters of single nucleus or all possible residual nuclei in a neutron induced reaction. Systematics and the theoretical research on this field will be done to obtain the giant resonance parameters reliable.

4. Level density parameters

This file consists of two parts. One of them is related experimental data which contains two kinds of experimental data, $D_o$evaluated by our code AVRPES and $N_o$the cumulative number evaluated by our work. The amount of the collected data is about 650. We also collected the $\Gamma_\gamma(J,\pi,B_n)$ in this part. Other one is setting up a file in which three kinds of level density formulae, Gilbert–Cameron(including three sets of

parameters recommended by Gilbert and Cameron, Cook et al. as well as Su et al.), Back–Shifted Ferim gas(including two sets of parameters recommended by Dilg et al. and Huang et al.) and Ignatyuk formula, users can chose one of them for calculations

5. Optical model parameters

As our first step, we are setting up a OMP file in which the Optical model parameters are from CENLD–1 and CENLD–2 to test the format and to get the best way to built up the file. We will continue to compile OMP we get.

A working group for this file has been organized in China to do the studies of optical model potential, potential parameters systematics and application of some recent research achievements.

6. Fission parameters

Three types of fission parameters, which are compiled by Lyun, Back and Britt and T.Ohsawa, have been collected and this file has been finished (first edition) and related retrieval code(second edition) has been written. We will continue to compile the different types of fission parameter and to put them into our file. We will do some researches on this file.

Users can get and chose any parameters mentioned above by our using retrieval code system. The retrieval system will be done in the way of dialogue between user and the computer. CENPL are available for any kinds of computer and including PC.

Drs. Huang Zhongfu of Guangxi Univ., Zuo Yixin, Yu Ziqiang of Nankai Univ., Liu Jianfeng of Zhengzhou Univ., Zhang Limin, Zhao Fengquan and Jin Yongli of CNDC join this work.

We sincerely thank IAEA and BNL to give us some information and suggestions.

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1. EVALUATION WORKS ON PARTICULAR NUCLIDES

i) NEUTRON NUCLEAR DATA EVALUATION FOR ^{238}U

The evaluation of neutron nuclear data of ^{238}U for CENDL-2 was finished. Comparing to CENDL-1, the resonance parameters have been added and all pointwise data have been renewed. Comparing to ENDF/B-V, most of the data were renewed. All the relatively measured data (to ^{235}U and ^{197}Au) have been renormalized to ENDF/B-VI data file. For theoretical calculation the new improved code of FUP1 was used. The recommended experimental data and the theoretical calculated data were adjusted and let $\sigma_{tot}=\sigma_{el}+\sigma_{non}$. The resonance parameters in the neutron energy range below 10 keV were took from ENDF/B-VI. All the data in the energy range 10^{-5} eV to 20 MeV were recommended as the data file of ^{238}U for CENDL-2. The data was checked with integral data and the consistent was well.

ii). NEUTRON NUCLEAR DATA EVALUATION FOR ^{237}Np

The measured data of (n, f), (n, gamma) reaction for ^{237}Np have been evaluated in the energy region from 30 Kev to 20 MeV. All the data of ^{237}Np for other reaction channels were theoretically calculated. The total cross section, absorption cross section and elastic angular distribution were calculated using the parameters got from Optical Model. All data were calculated using general code FUP1 (the parameters of the Optical model used as input data to FUP1). The recommended experimental data

and the theoretically calculated data were adjusted and let $\sigma_{tot}=\sigma_{el}+\sigma_{non}$. The resonance parameters in the energy range below 30 keV were also added. All the data in the energy range 10^{-5} eV to 20 Mev were recommended as the data file of ^{237}Np for CENDL-2.

ii). RENEW OF NEUTRON NUCLEAR DATA FOR NATURAL SI AND MG

The main advancement of our recommended data is that all data were calculated using MUP2 code[1] and the data for (N,N'P), (N,N'alpha), (N,2alpha) reactions were derived from (N,P), (N,alpha) reactions. Further detail of our works can be seen from CENDL-2.

Beside the data of total cross section(MT=1), the cross sections of radiative capture, (N,P), (N,Alpha) reactions and all other reactions, the data of angular distributions for elastic and inelastic scattering and the energy distribution of secondary neutron were taken from the calculations using MUP2 code.

2. WORKS RECENTLY COMPLETED AND IN PROGRESS

i). MEASUREMENT OF $^{7}li(n.n')$(478keV) INELASTIC ANGULAR DISTRIBUTION

The measurement was done at neutron energy point at 14.9MeV via the method of shape analysis of measured Doppler shifted gamma-ray spectra at different laboratory angles[1] in last year using the pulsed neutron generator of Beijing Normal University and the similar experiments were done at neutron energy points 9, 10MeV with D(d, n) neutron source of pulsed beam of 2x 13MeV tandem in Institute of Beijing Atomic Energy. The data were theoretical calculated using the code DUCK4, which was slightly modified in order to meet the parameter auto-research on Optical Model. The calculation was carried out in energy range 8 to 20 MeV step 2 MeV[2]. Further calculation will be done using Coupled Channel Optical Model in order to improve the

the redults influenced by other levels of ^{7}Li.

ii) THE MEASUREMENT OF THE INTEGRAL PROMPT SPONTANEOUS FISSION NEUTRON SPECTRUM

This is a relative measurement of ^{248}Cm to ^{252}Cf, which was cooperated with Dr. M. V. Blinov, V. G. Hhlopin Radium Institute, Leningrad, Russia. The primary results shows that the neutron spectrum in the energy range below 500keV had a extra component compared with Maxwell distribution at T=1.38MeV[3].

3. RECENT PUBLICATIONS

1). Bao Shanglian, Huang Feizeng, and Zhou Hongyu, Fan Guoying, Wen Shenlin, Hua Ming: "Measurement of $^{7}Li(n, n')$ (478keV) Inelastic Angular Distribution Derived via the Shape Analysis of the Doppler Shifted gamma-ray Spectrum (DSM) at 14.9 MeV", Proc. on Inter. Conf. on Nuclear Data for Science and Technology", Jullich, Germany, May 9-13, 1991.

2). Huang Feizeng, Bao Shanglian, "DWBA Calculation of the Neu tron Angular Distribution of $^{7}Li(n,n')$ Reaction", in Chinese Jan. of Nuclear Physics, 1991.

3). O. I. Batenkov, M. V. Blinov, V. G. Khlopin Radium Institute, Leningrad, USSR and Bao Shanglian, "The Measurement of Spontaneous Fission Neutron Spectrum Measurement of ^{252}Cf to ^{248}Cm", Proceeding as /1/.

4). Bao Shanglian, "Study of Prompt Neutron Spectrum At Low Energy Portion For ^{252}Cf and ^{248}Cm Spontaneous Fission", Proc. on Beijing Inter. Sym. on Fast Neutron Physics, Sep. 9-13,1991.

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Evaluation of (n,2n) excitation functions for ^{238}U, ^{232}Th and ^{237}Np target nuclei

Foil activation technique by Ge(Li) and HP Ge gamma-spectrometers have been applied to determine (n,2n) cross sections for ^{238}U as well as ^{232}Th nuclei in the energy ranges 6-10.5 MeV (10 and 11 points, respectively) and 13.5-14.8 MeV (5 and 6 data, respectively). Four control irradiations have also been performed for the 6-10.5 MeV region and ten ones for the 14 MeV energy value [1-3].

The $^{237}Np(n,2n)^{236m}Np$ cross section has also been determined at 7 different energy points in the range of 7 to 10 MeV.

The above measurements - mainly from 6 to 10.5 MeV - are important for the excitation functions having not enough data earlier. The best overall precision achieved is 3.4 to 5 % [1].

Statistical reaction model calculations - including pre-equilibrium emission as well as Hauser-Feshbach type contributions - have been done to obtain both (n,xn) and (n,f) excitation functions up to 22 MeV bombarding neutron energy for all the three target nuclei. Above 3 MeV, the agreement with the experiments is quite satisfactory. The level density parameters have been chosen to be constant with respect to the excitation energy. The calculations have been performed by the computer code STAPREF [1,4].

[1] P. Raics, Investigations on the (n,2n) excitation functions for the ^{238}U, ^{232}Th and ^{237}Np nuclei (a Thesis for Candidature in Physicsal Sciences), Kossuth University, Debrecen, 1990 (in Hungarian)

[2] P.Raics, S.Daróczy, J.Csikai, N.V.Kornilov,V.Ya. Baryba, O.A.Salnikov, Measurement of the cross sections for the $^{238}U(n,2n)$ and $^{232}Th(n,2n)$ reactions in the 13.5 - 14.8 MeV energy range, INDC(HUN)-029/L 1990

[3] N.V.Kornilov and P.Raics, Evaluation of the excitation function for the $^{232}Th(n,2n)^{231}Th$ reaction from threshold to 21 MeV, Acta Phys. Hung. 69 (1991) pp.143-149.

[4] P.Raics, Statistical model calculation of the (n,xn) and (n,f) reaction cross sections for nuclei Th-232, U-238 and Np-237, Acta Phys. Hung., 69 (1991) pp. 151-168.

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In order to strengthen the data base near the threshold of some neutron induced reaction cross-sections and under the CRP on cross-sections relevant to the generation of long-lived activities [1], the $^{151}Eu(n,2n)^{150m}Eu$ and the $^{159}Tb(n,2n)^{158}Tb$ cross-sections were measured in the range of 8.7 - 10.7 MeV [2]. Other measurements are in progress[3].

[1] Wang DaHai (Ed.), Activation cross sections for the generation of long-lived radionuclides of importance in fusion reactor technology, IAEA Report INDC/NDS/-232/L, 1990.

[2] S.M. Qaim, F.Cserpák and J.Csikai, Cross sections of $^{151}Eu(n,2n)^{150m}Eu$ and $^{159}Tb(n,2n)^{158}Tb$ reactions near these thresholds, Appl. Radiat. Isot., 43 (1992) 1065; Int. J. Radiat. Appl. Instrum. Part A.

[3] $^{63}Cu(n,\alpha)^{60m}Co$; $^{65}Cu(n,\alpha)^{62m}Co$ and $^{65}Cu(n,\alpha)^{62m}Co$ to $^{65}Cu(n,\alpha)^{62m+g}Co$ ratio for 6 to 12 MeV and at around 14 MeV energies.

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A number of neutron induced cross-sections were measured of different zirconium isotopes at neutron energies of 5.4, 5.9, 6.4, 6.8, 8.2, 8.4, 8.9, 9.4, 10.2, 11.0, 11.6 and 12.3 meV. The reactions are $^{90}Zr(n,\alpha)^{87m}Sr$, $^{90}Zr(n,p)^{90m}Y$, $^{91}Zr(n,p)^{91m}Y$, $^{92}Zr(n,p)^{92}Y$, $^{94}Zr(n,\alpha)^{91}Sr$ and $^{96}Zr(n,2n)^{95}Zr$. According to the preliminary report [1], the results seem to be in reasonable agreement with those measured by Majah and Qaim [2]. (Due to the scarce data, no serious evaluation is possible.) In addition, the $^{94}Zr(n,p)^{94}Y$ cross-section was also measured at two energy points.

[1] P.Raics, S.Nagy, S.Szegedi, N.V.Kornilov and A.B. Kagalenko, Cross section measurements of neutron induced reactions on the zirconium isotopes in the energy range of 5.4 to 12.3 MeV. Proc. Internat. Conf. on Nucl. Data for Sci. and Techn. (13-17 May 1991, Jülich), S.M.Qaim (Ed.), Springer, pp.660-662.

[2] M. Ibn Majah and S.M.Qaim, Nucl. Sci. Eng. 104 (1990) 271.

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For strengthening the data base for n,p cross-sections on some nickel isotopes, the $^{60}Ni(n,p)^{60m}Co$, $^{60}Ni(n,p)^{60m+g}Co$ and $^{58}Ni(n,p)^{58m}Co$ reaction cross-sections were measured from 5 to 12 MeV energies [1]. The measured data for the $^{60}Ni(n,p)^{60m+g}Co$ reaction deviate considerably from the ENDF/B-V data and the data of Paulsen [2] and do not show the earlier found structure.

[1] S.Sudár, J.Csikai, S.M.Qaim and G.Stöcklin, Neutron activation cross sections for $^{60}Ni(n,p)^{60m}Co$, $^{60}Ni(n,p)^{60m+g}Co$ and $^{58}Ni(n,p)^{58m}Co$ reactions in the 5 to 12 MeV energy range. Proc. Internat. Conf. on Nucl. Data for Sci. and Techn., (13-17 May 1991) Jülich, S.M.Qaim (Ed.) Springer, pp. 291-293.

[2] A. Paulsen, Nukleonik 10 (1967) 91.

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Cross-section curves of (n,n') and (n,2n) reactions on ^{113}In leading to isomeric and ground states have been measured in the 2.1-2.9 and 13.5-14.8 MeV intervals using D-D and D-T neutrons, respectively. Results obtained for (n,n') and (n,2n) reactions in the 13.5-14.8 MeV interval are in good agreement with the recent recommended values. Precise cross-sections measured for the ^{113}In(n,n')^{113m}In reaction in the 2.1-2.9 and 13.5-14.8 MeV ranges are needed for standardization of the excitation function [1].

[1] Cs.M.Buczkó, J.Csikai, T.Chimoye and B.W. Jimba, Cross-sections of ^{113}In(n,n')^{113m}In and ^{113}In(n,2n)^{112m,g}In reactions around 2 and 14 MeV neutron energies. Proc. Internat. Conf. on Nucl. Data for Sci. and Techn. (13-17 May 1991, Jülich), S.M. Qaim (Ed.), Springer, pp. 656-659.

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Work recently completed and published

1) M. Kawai, S. Iijima, T. Nakagawa, Y. Nakajima, T. Sugi, T. Watanabe, H. Matsunobu, M. Sasaki and A. Zukeran: "JENDL-3 Fission Product Nuclear Data Library", J. Nucl. Sci. Technol., 29, 195 (1992).

   Neutron nuclear data in the energy range from 10^{-5} eV to 20 MeV were evaluated for 172 nuclei from ^{75}As to ^{159}Tb in the fission product mass region.

2) H. Derrien: "Neutron Total Cross Sections of ^{239}Pu from Transmission Measurements in the Energy Range of 1-500 keV", J. Nucl. Sci. Technol., 29, 794 (1992).

   The average neutron total cross section was obtained from the high resolution transmission measurements by Harvey et al. at the Oak Ridge Electron Linear Accelerator (ORELA). The results are given with 2% to 4% accuracy in the energy range of 1-10 keV, and with better than 2 % above 10 keV.

3) S. Chiba, B. Yu and T. Fukahori: "Evaluation of JENDL Fusion File", JAERI-M 92-027, p. 35 (1992).

   Preparation of JENDL Fusion File is in progress in order to improve neutron DDX of nuclei related to fusion neutronics. This report explained the evaluation method of the data and the present status of the file.

4) T. Ohsawa: "Theoretical Models for Calculation of Fission Neutron Spectra", JAERI-M 92-027, p.82 (1992)

   Progress in the theoretical calculation of the fission neutron spectra was reviewed and a non-equi-temperature Madland-Nix model was proposed.

5) T. Kawano, H. Tanaka, K. Kamitsubo and Y. Kanda: "Parameters of Reaction Cross Section Calculation for Medium Nuclei", JAERI-M 92-027, p.225 (1992)

   Reaction cross sections for neutron induced reactions of ^{58,60}Ni, ^{59}Co and ^{54,56}Fe were calculated with some combinations of neutron and proton optical model parameters, and level density parameters were adjusted so as to reproduce available experimental data.

6) K. Kitao: "Production and Radiological Impact of Argon-39", JAERI-M 92-027, p.249 (1992)

   The quantity of argon-39 released from the nuclear installation following production of neutrons was calculated based on the cross sections predicted by the theoretical calculation codes, EGNASH and ALICE.

7) T. Fukahori: "ALICE-F Calculation of Nuclear Data up to 1 GeV", JAERI-M 92-035, p.114 (1992)

Calculation of neutron and proton induced nuclear data of ^{208}Pb and ^{209}Bi was performed with ALICE-F and compared with experimental data.

8) N. Kishida: "Comparison between Calculated Cross Sections by MCEXCITON and ALICE-P for Medium-Energy Nucleon Induced Reactions on ^{208}Pb and ^{209}Bi", JAERI-M 92-039, p.123 (1992)

Particle-production and nucleus-formation cross sections in the incident nucleon (neutron and proton) energy range of 20-1000 MeV were calculated for ^{208}Pb and ^{209}Bi by using an MCEXCITON code. Results were compared with experimental data and calculations with ALICE-P.

9) T. Fukahori, S. Chiba and T. Asami: "Comparison of Double-Differential Neutron Emission Cross Sections Calculated from Evaluated Nuclear Data Libraries with Experimental Data", JAERI-M 92-053 (1992)

The DDX of neutron emission calculated from JENDL-3, ENDF/B-VI and JEF-2 were compared with experimental data measured at Tohoku University and Osaka University. Many graphs are given in this report.

10) (Ed.) T. Nakagawa and T. Narita: "JENDL Gas-Production Cross Section File", JAERI-M 92-076 (1992)

The JENDL Gas-Production Cross Section File was compiled by taking the data from JENDL-3. The data were given for 23 nuclei or elements.

11) (Ed.) T. Nakagawa: "Curves and Tables of Neutron Cross Sections of Fission Product Nuclei in JENDL-3", JAERI-M 92-077 (1992)

The cross section data of 172 nuclei published as J. Nucl. Sci. Technol., 29, 195 (1992) and stored in JENDL-3 were shown in graphs and tables.

The following papers were presented at International Symposium on Nuclear Data Evaluation Methodology, 12-16 Oct., 1992, BNL.

12) T. Fukahori and S. Chiba: "Intercomparison of Double-differential Cross Sections and Evaluation Method for JENDL Fusion File"

13) M. Kawai, A. Hasegawa, K. Ueki, N. Yamano, T. Nakagawa and Y. Kikuchi: "Systematic Shielding Benchmark Tests of JENDL-3 and Their Feedback to Nuclear Data Evaluation"

14) Y. Kanda: "^{238}U Capture and Inelastic Scattering"

15) S. Chiba and D.L. Smith: "Perspectives on Peelle's Pertinent Puzzle and Its Significance in Data Fitting and Evaluation"

16) K. Ishibashi, S. Sakaguchi, K. Higo, Y. Wakuta, H. Takada, T. Nishida and Y. Nakahara: "Moving Source Models for Evaluating the Double Differential Cross Sections of Neutron-Emission and Fragmentation"

17) N. Kishida: "Methods used in Photonuclear Data Evaluation at JNDC"

18) T. Fukahori, T. Nakagawa, T. Narita, Y. Kikuchi and T. Asami: "Integrated Nuclear Data Evaluation System Applying Knowledge Engineering Technology"

19) Y. Kanda: "Determination of Covariances of calculated Cross Sections"

20) H. Maekawa: "Benchmark Experiments for Fusion Neutronics and Data Testing of JENDL-3"

Work in progress

1) D. Tian, A. Hasegawa, T. Nakagawa and Y. Kikuchi: "Benchmark Tests of Principal Fissile Nuclides in JENDL-3 with Simple Fast Critical Assemblies", submitted to J. Nucl. Sci. Technol.

   Benchmark tests were made to check the JENDL-3 data for ^{233}U, ^{235}U and ^{239}Pu by using integral data of small assemblies with single material, high enrichment and simple geometry.

2) N. Odano, S. Iwasaki and K. Sugiyama: "Estimate of (n,p) Cross Sections for Unstable Nuclide ^{60}Co by Multi-step Hauser-Feshbach Model with Pre-equilibrium Correction", submitted to J. Nucl. Sci. Technol.

   Cross section calculation has been performed with SINCROS-II. Optimum nuclear model parameters for ^{60}Co were determined by parameter fitting with existing data for ^{59}Co and (p,n) reactions of iron isotopes.

3) H. Derrien: "R-Matrix Analysis of ^{239}Pu Neutron Transmission and Fission Cross Section in the Energy Range from 1.0 keV to 2.5 keV", submitted to J. Nucl. Sci. Technol.

   The results of the ^{239}Pu high resolution transmission measurements by Harvey et al. and of the high resolution fission cross section measurements by Weston and Todd at ORELA were analysed in the energy range from 1 to 2.5 keV with SAMMY. The previous results up to 1 keV were up-dated. Statistical properties of the parameters were examined.

4) H. Derrien: "Evaluation of ^{233}U Resolved Resonance Parameters up to 150 eV"

   Effective total cross section, fission cross section and capture cross sections were analyses with the Bayesian code SAMMY in order to obtain the Reich-Moore resonance parameters in the energy range from 0 eV to 150 eV. Preliminary results in the ENDF-6 format are available.

5) S. Igarasi: "Evaluation of Photoreaction Nuclear Data on ^{209}Bi"

Evaluation for photoreaction nuclear data of ^{209}Bi has been done. The photoabsorption cross section was calculated using the giant dipole resonance with two peaks and quasideuteron models. Branching ratios for particle emission were calculated using a computer code ALICE-F.

Work about Codes

1) S. Iwasaki: "A Guidance System of Nuclear Data Evaluation in Object Oriented Environment – Adjustment Procedure of Nuclear Model Parameters", JAERI-M 92-027, p.135 (1992)

2) T. Fukahori and T. Nakagawa: "Prototype of Evaluation Guidance System in Integrated Nuclear Data Evaluation System", JAERI-M 92-027, p.214 (1992)

   An evaluation guidance system (ET: Evaluation Tutor) was developed to select a set of suitable theoretical calculation codes for nuclear data evaluation. Knowledge engineering technology was applied.

Work planned for the near future

1) "Cobalt and Gold Dosimetry Cross Sections from 1 to 50 MeV"
   S. Iwasaki, N. Odano

   Dosimetry reaction cross sections of cobalt and gold are obtained on the basis of nuclear model calculations in the energy range up to 50 MeV.

2) "Evaluation of Neutron Nuclear Data of ^{237}U, ^{236}Np and ^{238}Np"
   T. Nakagawa, et al.

   The data will be evaluated in the energy range below 20 MeV and stored in JENDL actinide file.

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1. RECENT PUBLICATIONS AND REPORTS

[1] J. Kopecky, M. Uhl and R.E. Chrien, Distribution of Radiative Strength in Gd-156, 157 and 158 Nuclei, ECN-RX--92-011.
[2] M. Uhl and J. Kopecky, Neutron Capture Cross Sections and Gamma-Ray Strength Functions, ECN-RX--92-055, Contr. Second Int. Symoposium on Nuclear Astrophysics - Nuclei in Comos-Karlsruhe, July 6-10, 1992.
[3] J. Kopecky and M. Uhl, Status of Statistical Model Capture Calculations, ECN-RX--02-064, Contr. Symposium on Nuclear Data Evaluation Methodology, BNL (USA), October 12-16, 1992.
[4] H.A.J. van der Kamp and H. Gruppelaar, Revision of JEF-2 Evaluation for the Long-lived Fission Products I-129 and Tc-99, ECN-RX--92-023.
[5] H.A.J. van der Kamp, The JEF-1 and JEF-2 Fission Product Cross-Section Files, ECN-RX--92-021.
[6] H. Gruppelaar and A. Hogenbirk, Direct and Preequilibrium Effects in the Fission-Product Mass Range, ECN-RX--92-040.
[7] A.J. Koning, Multi-Step Direct Reactions, PhD Thesis and ECN-R--92-004.
[8] A.J. Koning, Theoretical and Practical Intercomparison of Multi-Step Direct Reactions, Proc. Workshop on Multi-step Direct Reactions, Faure (South Africa), September 30- October 2, 1991, (World Scientific, 1992) and ECN-RX-92--043.
[9] A.J. Koning, Quantumechanical Multi-Step Direct Models for Nuclear Data Applications, Contr. Symposium on Nuclear Data Evaluation Methodology, BNL (USA), October 12-1116, 1992.
[10] E. Betak, J. Kopecky and J. Cvelbar, The Pre-equilibrium Picture of Nucleon Radiative Capture and the Neutron-to-Gamma Competition, Phys. Rev. C46 (1992) 945.
[11] J. Kopecky, M. Uhl and R.E. Chrien, Radiative Strength in the Compound Nucleus Gd-157, accepted for publication in Phys. Rev.

2. WORK RECENTLY COMPLETED

- See above-mentioned publications and reports.
- Update of activation cross-section file; EAF-3 (see EFF-EAF contribution).
- Revision of thermal and resolved-resonance range of long-lived fisson product isotopes Tc-99 and I-129 for transmutation studies.
- Completion of code system for Multi-Step Direct Reactions.
- Calculation of neutron elastic and inelastic scattering cross sections of Pd isotopes at low neutron energies.

3. WORK IN PROGRESS

- Improvements of EFF library, EFF-2.3 revision to be released in January 1993 (see EFF-EAF contribution).
- Extension of the activation file, compilation of the European Activation File (EAF-4) to be released in 1993 (see EFF-EAF contribution).
- Study of photon production cross-sections and spectra calculations for deformed targets.
- Study of available experimental data and model codes for high energy reactions.

4. FUTURE PLANS

- Update of fission-product cross-sections.
- Work for EFF-2 (European Fusion File) and FENDL (IAEA, ITER).
- Theoretical study of pre-equlibrium processes.
- Extension of pre-equilibrium process to higher energies.
- Update of working libraries for nuclear transmutation studies of actinides and fission-products.

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Names:	A. Marcinkowski and D. Kielan
Activity:	Investigation of neutron induced neutron emission and proton emission cross sections. Activation measurements and model calculations of cross sections.
Facilities:	3 MeV Van de Graaff accelerator, 80 cm^3 Ge(Li) spectrometer, HP Apollo 720 work station.
Work in progress:	Excitations functions for ^{96,99,101,102,104}Ru(n,p) and ^{64,66,67,68}Zn(n,p) reactions for incident energies from 13.0 MeV to 16.6 MeV. Neutron emission cross section for ^{165}Ho and ^{181}Ta at 20 MeV incoming neutron energy (in collaboration with Ohio University).
Data evaluation:	Calculations of neutron induced nucleon emission cross sections implementing the multistep compound and multistep direct theories of Feshbach, Kerman and Koonin and of Nishioka, Verbaarschot, Weidenmüller and Yoshida. PC computer code for MSD calculations. Extended version of EMPIRE for MSC calculations.
Publications:	A. Marcinkowski et al., Nucl. Phys. A510(1990)93; Nucl. Phys. A530(1991)75; H. Hoang et al., Z. Phys. A - Hadrons and Nuclei 342(1992)283.

Names:	Dr. Bogdan Zwiegliński and Dr. A. Trzciński
Activity:	Development of the neutron detection methods for the intermediate energy heavy ion reactions. Collaboration with the Gesellschaft für Schwerionenforschung mbH (GSI), Darmstadt, Germany.
Facilities:	4 IBM-PC computers, HP AOLLO 720 workstation.
Work in progress:	Development of the Monte-Carlo code for the modelling of the neutron multiplicity meter based on the slowing down and capture principle in the Gd loaded organic scintillator.

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I. Recent publications

1. P. Obložinský, S. Hlaváč, G. Maino and A. Mengoni: "Gamma-ray production from $^{52}Cr(n,x\gamma)$ reactions at 14.6 MeV", Nuovo Cimento **A105** (1992) 965.

2. E. Běták, J. Kopecky and F. Cvelbar: "Another possible manifestation of the energy-dependent width of the giant dipole resonance", Phys. Rev. **C46** (1992) 945.

3. M. B. Chadwick and P. Obložinský: "Particle-hole state densities with linear momentum and angular distributions in preequilibrium reactions", Phys. Rev. **C46** (1992) No.5 (November issue).

4. P. Obložinský and M.B. Chadwick: "Calculations of photoproduction cross sections", invited paper at the Inter. Conf. Nucl. Data Sci. Tech., Jülich'91, ed. S.M. Qaim (Springer Verlag, Berlin 1992) p.842.

5. E. Běták, F. Cvelbar and J. Kopecky: "The pre-equilibrium picture of nucleon radiative capture and the neutron-to-gamma competition", Inter. Conf. Nucl. Data Sci. Tech., Jülich'91, ed. S.M. Qaim (Springer Verlag, Berlin 1992) p.888.

II. Work recently completed

Code PEGAS (E. Běták and P. Obložinský)

PEGAS is the Preequilibrium-Equilibrium-Gamma-And-Spin code based on the unified model of nuclear reactions. This model combines in a natural way the preequilibrium reaction concept with the statistical (equilibrium) decay. The code has two important novel features: spin conservation including all angular-momentum couplings is fully and correctly taken into account, and multiple preequilibrium emission of nucleons as well as γ rays including their cascades is considered. This second point is achieved by solving a large set of coupled differential master equations. The code is designed to run on small PC computers under the DOS operational system. This limits the use of the code to excitation energies $E_{exc} < 35\,MeV$ and angular-momenta to $J < 15\hbar$.

The code is available from the Nuclear Data Sections of the International Atomic Energy Agency in Vienna or directly from the authors.

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P.E. Hodgson

I. RECENT PUBLICATIONS

1. Analysis of Multistep Reaction Cross-Sections with the Feshbach-Kerman-Koonin Theory. By P.E. Hodgson. XXth International Symposium on Nuclear Physics: "Nuclear Reaction Mechanisms". Castle Gaussig, Dresden. Ed. D. Seeliger and H. Kalka. World Scientific, 1991, 103.
2. Pre-Equilibrium Reactions. By P.E. Hodgson. Proceedings of the 6th International Conference on Nuclear Reaction Mechanisms, Varenna, June 1991. Ed. E.Gadioli. *Ricerca Scientifica ed Educazione Permanente, Supplemento n.84*, 1.
3. Energy and Angular Distribution Calculations for Pre-Equilibrium Reactions. By M. Avrigeanu and P.E. Hodgson. Proceedings of the 6th International Conference on Nuclear Reaction Mechanisms, Varenna, June 1991. Ed. E.Gadioli. *Ricerca Scientifica ed Educazione Permanente, Supplemento n.84*, 191.
4. Multistep Processes in Nuclear Reactions. By P.E. Hodgson. Proceedings of the International Seminar on Direct Nuclear Reactions, Bangalore 1989. Edited by N.G. Puttaswamy. *Indian Academy of Sciences* **223** 1991.
5. Further tests of the Weisskopf-Ewing Exciton Model. By S. Ait-Tahar. *J. Phys.* **G17** 1833, 1991.
6. Pre-Equilibrium Nuclear Reactions. By E. Gadioli and P.E. Hodgson (Oxford University Press, 1992).
7. The Relation between Normal and Non-Normal DWBA Matrix Elements. By M.S. Hussein and P.E. Hodgson. Oxford Report OUNP–92–08, 1992.
8. Introduction to Nuclear Reaction Theory. By P.E. Hodgson. Faure Meeting on Multistep Direct Reactions. Oxford Report OUNP–92–09, 1992.
9. Quantum-Mechanical Theories of Pre-Equilibrium Reactions. By P.E. Hodgson. Faure Meeting on Multistep Direct Reactions. Oxford Report OUNP–92–09, 1992.
10. The Future Development of Multistep Theories. By P.E. Hodgson. Faure Meeting on Multistep Direct Reactions. Oxford Report OUNP–92–09, 1992.
11. Comparative Semi-Classical and Quantum-Mechanical Nucleon Pre-Equilibrium Emission Calculations. By M. Avrigeanu and P.E. Hodgson. International Centre for Theoretical Physics, Miramare-Trieste. Report IC/92/31, 1992.
12. The Dispersive Optical Model. By P.E. Hodgson. Proceedings of the International Conference on Nuclear Data for Science and Technology. Julich May, 1991. Ed. S.M. Qaim. 768, 1992.
13. International and Nuclear Model Code Comparison Study of Hauser-Feshbach Calculations. By P.E. Hodgson, E. Sartori and K. Shibata. Proceedings of the International Conference on Nuclear Data for Science and Technology. Julich, May 1991. Ed. S.M. Qaim, 971, 1992.
14. The Interaction of 1- to 20-MeV Neutrons with ^{238}U. By A.C. Merchant, P.E. Hodgson and H.R. Schelin. Nucl. Sci. Eng. **111**, 132, 1992.
15. Calculations using the Stapre Code for Alpha-Induced Reactions. By Lu Haitao. Oxford Report OUNP–92–12.
16. Statistical Multistep Direct Calculations for (p,p') Continuum Spectra up to 200 MeV. By W.A. Richter, A.A. Cowley, R. Lindsay, J.J. Lawrie, S.V. Förtsch, J.V. Pilcher, R. Bonetti and P.E. Hodgson. Contribution 3.1.42 to the International Nuclear Physics Conference, Wiesbaden, 26 July — 1 August, 1992.

17. Multistep Processes in Nuclear Reactions. By P.E. Hodgson. Contribution 3.1.43 to the International Nuclear Physics Conference, Wiesbaden, 26 July — 1 August, 1992.
18. Multistep Processes in Nuclear Reactions: The Feshbach-Kerman-Koonin Theory. By P.E. Hodgson. Paper contributed to the International Nuclear Physics Conference, Wiesbaden, 26 July — 1 August, 1992.

II. WORK RECENTLY COMPLETED AND IN PROGRESS

1. Statistical Multistep Compound Reactions

(H.B. Olaniyi, P. Kanjanarat and P.E. Hodgson)

The quantum-mechanical theory of Feshbach, Kerman and Koonin (Feshbach 1980) has been used successfully to analyze pre-equilibrium nucleon emission data at different energies by various authors. We have analyzed the backward angle (n, n') reaction data of Takahashi group for 14.1 MeV neutrons using the FKK formalism. The aim of the work is to study the basis and assumptions on which the theory is based and the effect of some of the input parameters on the predictive power of the theory. So far, the sensitivity of the double differential cross section to input data such as the level density parameter, the spin cut-off parameter, and the nucleon pairing energy has been carefully investigated. The contribution due to collective excitation to the low lying vibrational states was calculated using the method of Kalka *et al* (Kalka 1990). Contributions from $(n, 2n)$ and (n, pn) to the low energy part of the spectrum were calculated using Hauser-Feshbach theory.

References

[1] H. Feshbach, A. Kerman and S. Koonin, *Ann. Phys.* **125**, 429 (1980)
[2] H. Kalka *et al*, *Z. Phys.* **A335**, 163 (1990)

2. Statistical Multistep Direct Reaction

(H.B. Olaniyi and P.E. Hodgson)

In the quantum-mechanical theory of multistep reactions by Feshbach, Kerman and Koonin (Feshbach *et al*, 1980), a distinction is made between the multistep direct (SMD) which is peaked in the forward direction and the multistep compound (SMC) which is symmetric about 90°. The excess of the cross section in the forward direction over that in the backward direction is taken to be due to the multistep direct reaction. The analysis of this forward excess $(\sigma(30°) - \sigma(150°))$ for inelastic cross section for 14 MeV neutrons was started. A computer code based on the leading particle statistics of the quantum-mechanical Feshbach, Kerman and Koonin theory was written. The code uses the DWBA microscopic form factors to calculate the multistep direct reaction contribution to the cross section. So far, the contribution of the first stage, which is the major one, has been calculated. The angular distribution agrees very well with the experimental data. Contribution from the collective excitation of the low energy vibrational states has been calculated following the method of Kalka *et al* (Kalka 1990).

References

[1] H. Feshbach, A. Kerman and S. Koonin, *Ann. Phys.* **125**, 429 (1980)
[2] H. Kalka *et al*, *Z. Phys.* **A335**, 163 (1990)

3. Multistep Direct Reactions

(A.A. Cowley, R. Lindsay, W.A. Richter and P.E. Hodgson)

The double differential cross-sections for proton inelastic scattering by ^{58}Ni, ^{100}Mo and ^{197}Au at 100, 120, 150, 175 and 200 MeV have been analysed using the Feshbach-Kerman-Koonin multistep direct theory. A detailed study has been made of the sensitivity of the cross-sections to the parameters of the theory.

4. Comparative Semi-Classical and Quantum-Mechanical Nucleon Pre-Equilibrium Emission

(M. Avrigeanu and P.E. Hodgson)

The energy and angular distributions of pre-equilibrium nucleons from 14 MeV neutron interactions with target nuclei from ^{51}V to ^{58}Ni are analysed by the multistep compound theory of Feshbach, Kerman and Koonin and the semi-classical Geometry-Dependent

Hybrid model. The same parameter sets were used for both these calculations, with no free parameters. The calculations are compared with experimental data and the applicability of the theories assessed.

5. **Microscopic Calculation of Nucleon Optical Potential**
(W. Haider and J.R. Rook)

Within the framework of Brueckner theory, exact calculation of the direct part of the nucleon-Nucleus spin-orbit force has been done using Urbana-V14 soft-core and Hamada-Johnston hardcore inter-nucleon force. Thus the weakness of the short range approximation has been removed at least for the direct part of the calculated spin-orbit potential. The calculated spin-orbit potential is about 15% smaller than the approximate earlier results. The potentials have been used to study the elastic scattering and polarisation data for p-^{40}Ca at 30.3 MeV and 200 MeV. Various approximations are being studied to improve the calculation of the exchange part of the spin-orbit potential.

6. **Alpha-Nucleus Optical-model Potential**
(W. Haider and P.E. Hodgson)
The optical model analyses of alpha-nucleus elastic scattering data indicate that the volume integrals of the potential satisfy dispersion relation. However, the dynamic energy dependence, which the dispersion relation represents, has not been properly taken into account for analysing the elastic scattering data. Therefore, as a test case, an attempt is being made to construct an optical potential for α-^{40}Ca and ^{16}O, that includes the dynamic energy dependence also. The above potential is expected to reproduce the data at negative energies as well as elastic scattering over a wide energy range (18–166 MeV).

7. **Nucleon Optical Potential**
(J.R. Rook and W. Haider)
We have reconsidered the spin-orbit part of this potential. Firstly we have corrected the derivation of this potential presented previously by ourselves. Secondly we have improved the previous approximations made by many authors in performing actual calculations. Thirdly we have related most of the previous derivations to each other and made estimates of the errors made in these derivations.

8. **Local Density Approximation**
(J.R. Rook)
This approximation is at the heart of our previous calculations of the optical potential but its validity has never been seriously tested. In fact it is quite difficult to do this because, although the method is intuitively clear, its actual derivation has not been presented. We have so far found one simple property which can be calculated both in this approximation and exactly. We are comparing the results of these calculations to try to estimate the validity of the local density approximation.

9. **Numerical Calculation of Nucleon Optical Potential**
(J.R. Rook)
We are in the process of using the above results to calculate the optical potential. We have run into difficulties because we have found considerable differences between the results of calculations with modern internucleon potentials and those obtained previously with more old-fashioned potentials. The latter agree with the experimental data.

P.E. Hodgson
September 1992

Neutronic Evaluations in Progress and/or Planned

work by

Argonne National Laboratory
9700 South Cass Avenue
Argonne, Illinois, USA
and
The Physicist's Consultive
645 63rd Street
Downers Grove, Illinois, USA

I. Scandium

A. Specification

Comprehensive neutronic file in ENDF formats. The ENDF/B-6 system contains no such file.

B. Status

Neutronic file is presently complete, awaiting only the section dealing with photon production.

II. Elemental Zirconium

A. Specification

Comprehensive neutronic file in ENDF/B-6 formats, with emphasis on fast-reactor needs.

B. Status

The majority of the file is complete and the physical interpretation of the data base has been published. Work remaining to be done is confined to the photon production section and to several very small particle-emission reactions.

III. Cadmium Isotopes

A. Specification

Comprehensive neutronic files for the naturally-occurring isotopes of cadmium, presented in ENDF/B-6 formats. The emphasis is on fast-reactor fission-product usage, with particular attention to the neutron scattering processes.

B. Status

The experimental measurements are complete and their physical interpretation is nearing completion. The formulation of the evaluated file will start shortly.

IV. Palladium Isotopes

A. Specification

A comprehensive neutronic file for the naturally occurring isotopes of palladium, with emphasis on fast-reactor fission-product needs, particularly as they relate to the scattering processes.

B. Status

Experimental measurements have been completed, and their physical interpretation is nearing completion. Particular attention is being given to direct-reaction processes, and to fundamental theoretical understanding.

V. ^{103}Rh

A. Specification

A comprehensive neutronic file will be provided with emphasis on fast-reactor fission-product needs.

B. Status

The physical measurements have been completed, and their interpretation is well along. Particular attention is being given to the direct-reaction processes.

Participants in the above work are:-

1. A. B. Smith ANL/The Physicist's Consultive
2. J. W. Meadows ANL
3. R. J. Howerton LLNL
4. R. D. Lawson ANL

Information can be obtained from A. B. Smith at either of the above cited addresses.

BROOKHAVEN NATIONAL LABORATORY

ADDRESS National Nuclear Data Center
Advanced Technologies Division
Bldg. 197D
Brookhaven National Laboratory
Upton, NY 11973

NAMES C. L. Dunford, S. Pearlstein

COMPILED BY V. McLane

I. Recent Publications and Reports

The 92BNL Symposium on Nuclear Data Evaluation Methods was held in October; there were 100 paid attendees. The proceedings will be published by early spring in 1993.

II. Work Recently Completed

Evaluations by S. Pearlstein for neutrons and protons interacting with ^{12}C over the energy range 0 to 10 GeV, presented in the ENDF-6 format, have been sent to the National Nuclear Data Center. Below 32 MeV the neutron evaluation is consistent with the ENDF/B-VI evaluation for natural carbon. The evaluation methods are described in BNL-48035, a paper submitted to the 92BNL Symposium on Nuclear Data Evaluation Methods.

III. Status of ENDF Codes

The ENDF Utility codes release, version 6.8, has been completed and distributed. These programs are written to process ENDF-6 formatted files, including all formats approved through the May 1990 CSEWG Meeting with the exception of the generalized R-Matrix resonance region format and the generalized format for covariances (file 30).

EUROPEAN FUSION AND ACTIVATION FILES (EFF,EAF)

ADDRESS: Netherlands Energy Research Foundation ECN
P.O.Box 1
1755 ZG Petten
The Netherlands
Telefax: +31-2246-3490

NAMES: H. Gruppelaar, A. Hogenbirk, H.A.J. van der Kamp,
J. Kopecky (compiler) and D. Nierop

The EFF and EAF projects are part of the European Fusion Technology Programme of the European Community. The following laboratories are contractors in these projects: CEA (Saclay), ECN (Petten), ENEA (Bologna and Frascati), KfK (Karlsruhe) and AERE (Harwell). Moreover, JRC Ispra and CBNM (Geel) are involved as EC institutes. The projects are directed by the NET team at Garching and by EC in Brussels. Other European laboratories are also involved: the UK laboratories Birmingham and Culham (JET), IRK (Vienna), KFA (Julich), IKE (Stuttgart) and PSI (Wurenlingen). Furthermore, technical support is received from the NEA Data Bank.

1. RECENT PUBLICATIONS AND REPORTS

[1] J. Kopecky, H. Gruppelaar, H.A.J. van der Kamp and D. Nierop, European Fusion File, EFF-2 - Final report basic data file -, ECN-C--92-036.
[2] J. Kopecky, A. Hogenbirk and D. Nierop, Status of The European Fusion File (Revisions EFF-2.2 and EFF-2.3), EFF-Doc-156, EFF Newsletter - 1 (July 1992).
[3] A. Hogenbirk, H. Gruppelaar and D. Nierop, Modifications of the EFF-2 Be-9 evaluation, EFF-Doc-158, ECN-R-92-006.
[4] J. Kopecky and D. Nierop, Contents of EAF-3 - A supplement to the EAF-2 Data File -, ECN-I--92-023.
[5] J. Kopecky, H.A.J. van der Kamp, H. Gruppelaar and D. Nierop, The European Activation File EAF-3 with Neutron Activation Cross Sections, ECN-C--92-058.
[6] Revisions and Extensions of Neutron Capture Cross Sections in the European Activation File EAF-3, ECN-C--92-051.
[7] J. Kopecky, M.G. Delfini, H.A.J. van der Kamp, H. Gruppelaar and D. Nierop, Neutron Capture Cross Sections of Fission Products in the European Activation File EAF-3, ECN-RX--92-022.

2. WORK RECENTLY COMPLETED

- Evaluation and compilation of EFF-2.2 (released in July 1992).
- Evaluation and compilation of EAF-3 (released in April 1992).

3. WORK IN PROGRESS

- Work on EFF-2.3 revision (to be released in January 1993).
- Edition of document on graphical testing of EFF-2.
- Work on European Activation File (EAF-4).

4. FUTURE PLANS

- Improvements of EFF-2 library and corresponding working libraries.
- Benchmark studies for shielding of NET/ITER.
- Evaluation and compilation of EAF-4 (during 1993).

5. Distribution

There are no restrictions on the distribution of the EFF and EAF data libraries. The EFF-2.3 and EAF-3 versions are available from the NEA Data Bank starting January 1993.

IAEA Nuclear Data Section

Nuclear Data Section	e-mail: RNDS@IAEA1, BITNET
International Atomic Energy Agency	fax: (43-1)234564
P.O. Box 100	cable: INATOM VIENNA
A-1400 Vienna	telex: 1-12645 atom a
Austria	telephone: (43-1)2360-1709

Selected meetings

- Consultants' Meeting on nuclear data for neutron emission in the fission process. Vienna, 23-24 Oct. 1990. Proceedings edited by S. Ganesan, report INDC(NDS)-251.

- FENDL-2 and associated benchmark calculations. Vienna, 18-22 Nov. 1992. Proceedings edited by A.B. Pashchenko and D.W. Muir, report INDC(NDS)-260.

- Research co-ordination meeting on measurement and analysis of 14 MeV neutron-induced double differential neutron emission cross-sections for fission and fusion reactor technology. Chiang Mai, Thailand, 31 March - 2 April 1992.
  Contact: Wang Dahai

- Advisory Group Meeting on nuclear data requirements for fission reactor decommissioning. Vienna, 7-11 Sept. 1992.
  Contact: N. Kocherov

- Consultants' Meeting on charged-particle and photonuclear data libraries for IAEA FENDL project. Brookhaven, 8-9 Oct. 1992.
  Contact: A. Pashchenko

- Research co-ordination meeting on neutron-induced He production cross-sections. Debrecen, Hungary, 17-19 Nov. 1992.
  Contact: A. Pashchenko

Evaluated data files

- Index to BROND-2, CENDL-2, ENDF/B-6, JEF-1, JENDL-3. Document IAEA-NDS-107 Rev. 6, June 1992, H.D. Lemmel. (JEF-2 to be incorporated soon).

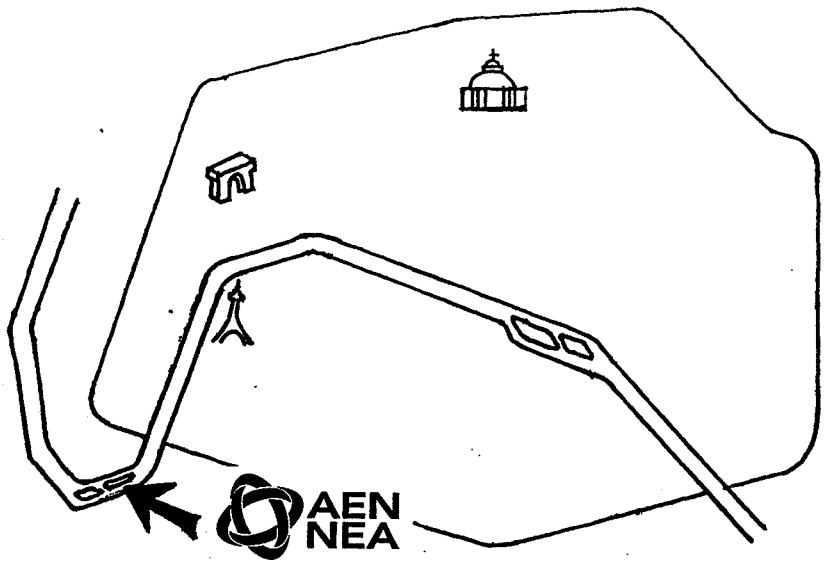
- FENDL Multigroup Libraries. Coupled neutron-gamma data files in MATXSR multigroup format. Contact: S. Ganesan. Document IAEA-NDS-129.

- For ENDF/B-VI and JENDL-3 special libraries that have become available see IAEA Nuclear Data Newsletter No. 17.

Publications

See IAEA Nuclear Data Newsletter No. 17, including table of contents of the Russian "Yadernye Konstanty".

RELOCATION OF THE NEA DATA BANK



The relocation of the whole of OECD Nuclear Energy Agency to new premises in Issy-les-Moulineaux was completed in September. The address of the new location is:

OECD Nuclear Energy Agency
Le Seine Saint-Germain
12, boulevard des Iles
F-92130 Issy-les-Moulineaux

Accordingly, the Data Bank telephone and fax numbers, and e-mail addresses have also been changed.

Telephone :	**+33 (1) 45 24 (plus 4 digits)**
Telefax :	**+33 (1) 45 24 11 10**
Telex :	**OCDE 620 160 F**

Nuclear Data Services :	**C. Nordborg**	**1092**
	M. Konieczny	**1085**
Computer Program Services:	**E. Sartori**	**1072**
	S. Greenstreet	**1077**
Chemical and Environmental Services:	**I. Puigdomenech**	**1083**
	S. Koo-Oshima	**1084**
On-line Services:	**P. Nagel**	**1082**
	R. Posca	**1086**

BITNET/EARN :	***name* @FRNEAB51**
INTERNET :	***name* @NEA.OECD.CIRCE.FR**
X-400 (ATLAS) :	C=FR P=NEA A=ATLAS O=OECD S= *name*
X25 (TRANSPAC) :	(1) 92 160 775
PHYSNET/HEPNET :	**Discontinued**

NEW AT THE DATA BANK ...

Changes to the On-line Service

Network access to on-line services using DECNET has been discontinued. On-line access to Data Bank services is now available via INTERNET or X25 (Transpac) - note that addresses for both of these networks have changed. Furthermore, the INTERNET symbolic address will be changed once more, probably to NEA.FR. This is expected to take effect by June. For on-line access one must logon as NEADB and give the assigned username and password. Unregistered users are allowed limited access via the GUEST account.

In order to encourage new on-line users, a direct sign-on procedure for new users from Data Bank countries has been implemented. A new "user friendly" screen-management system, supporting additional news and mail utilities, has been introduced. The new facilities are fully described in the document DBG-030.11"General User's Guide to the NEA Online Service", which is available via the on-line or as hardcopy.

JEF-2 Nuclides Database

The JEF-2 Nuclides Database is a PC package, developed at Birmingham UK, with the aim of allowing fast and easy access to the new JEF-2.2 decay data file. The chart of the nuclides is displayed in a window-based environment, from which information on individual radionuclides may be interrogated using cursor/mouse control. Information includes half lives, decay modes, gamma-ray and alpha-particle emission energies and emission probabilities plus their uncertainties. In addition, a line search facility accesses a listing of all alpha and gamma line data sorted by increasing energy. Spectral data can be printed or displayed on screen in numerical or graphical form, or spooled to disk files. Decay information is given for a total of 2346 nuclear states and 78645 decay lines including gamma, x-ray and alpha particles.

It is anticipated that this package will become available shortly after the official release of the JEF-2.2 decay data file. A similar package for display of independent and cumulative fission yield data in JEF-2 is currently under development, and is expected to become available later in the year.

Evaluated Data Libraries

During 1992, a number of new evaluated data libraries became available from the Data Bank. These are listed in Table 1.

Evaluated Files Processing and Handling Codes

Table 2 displays those computer codes that have been acquired by the NEA Data Bank since the last issue of the NNDEN, and which are relevant to work related with the processing and handling of different evaluations.

Almost all important codes have been revised during the course of the last two years and we recommend users to request them from the NEA Data Bank or form RSIC and NNDC for users from US and Canada, should they have not yet done so.

A comprehensive account of new codes and other news relating to computer program services is available in the "News from the NEA Data Bank", published regularly. Further information regarding the codes listed in Table 2, or other new codes recently acquired , is available in edition Number 14, 1992.

INDEX TO NEW DATA

Library-name(s)	Description
BROND-2	USSR Evaluated Neutron Data Library, version 2. Data is given for 121 materials from 1-H-1 to 96-Cm-244, including all relevant cross-sections and differential data of all relevant neutron-induced reactions in the energy range 1.0E-5 eV to 20 MeV. The library is in ENDF-6 format.
CENDL-2	Chinese Evaluated Nuclear Data Library, version 2. Contains data for 54 elements or isotopes form 1-H-1 to 98-Cf-249. Uses both ENDF-5 and -6 format.
EFF-2.2	European Fusion File, version 2.2. - Resolved resonance parameters, neutron transport data, gamma-production data, and covariance data. 59 nuclides.
JEF-2.2	Joint Evaluated File, version 2.2. - General Purpose Library
JENDL-3	Japanese Evaluated Nuclear Data Library - Special Purpose Dosimetry and Gas Production files. The dosimetry file gives cross section and covariance data for 61 reactions. ENDF-5 format.
UKHEDD-2	United Kingdom Heavy Element Decay Data - data for 126 heavy elements and actinides, including - references, half-lives, decay schemes, branching ratios, average decay energies, alpha beta and gamma energies and emission probabilities, internal conversion, and spontaneous fission decay data, and all associated uncertainties.
UKPADD-2	United Kingdom Product Activation Decay Data - 236 nuclides, ENDF-6 format

Table 1

INDEX TO NEW PROGRAMS

Program-name(s)	Description	Abstract
	ENDF Format File: Format and Physics Checking/Handling	
CHECKR-6.8	ENDF/B-5,ENDF/B-6 format check	USCD1135
STANEF-6.8	ENDF/B-5,ENDF/B-6 bookkeeping operations	USCD1135
PSYCHE-6.8	ENDF/B-5,ENDF/B-6 data consistency check	USCD1135
INTER-6.8	ENDF/B-5,ENDF/B-6 thermal x-sec, resonance integral, g factor calculation	USCD1135
GETMAT-6.8	ENDF/B-5,ENDF/B-6 material retrieval	USCD1135
FIZCON-6.8	ENDF/B-5,ENDF/B-6 x-sec redundancy check	USCD1135
	ENDF Format File Editing- Plotting- Utilities	
EVALPLOT-92.2	plot of ENDF-format point x-sec & angular distr & energy distr	IAEA0852
COMPLOT-92.2	ENDF-format utilty, compare, plot of reaction data	IAEA0852
PLOTTAB-92	curve & point plotting with error bars	IAEA0951
DICTION-92.1	reaction index generation of ENDF/B material	IAEA0847
MERGER-92.1	merge ENDF-format files by MAT or ZA	IAEA0847
VIRGIN -92.1	uncollided n flux & n reactions from transmission in ENDF/B material	IAEA0932
INDXENDF	visual data catalogue of ENDF/B data	IAEA1248
LISTEF-6.8	ENDF/B-5,ENDF/B-6 data file summary list	USCD1135
PLOTEF-6.8	ENDF/B-5,ENDF/B-6 data plot	USCD1135
GRALIB-6.8	emulator of DISSPLA plotting routines	USCD1135
	ENDF Format File Processing	
AMPX-77	modular sys for coupled n-gamma multigrp x-sec from ENDF/B-5	PSR-0315
LINEAR-92.1	lin lin interpolation of ENDF/B point x-sec	IAEA0847
RECENT-92.1	total x-sec,elastic x-sec,fission x-sec from ENDF/B resonance parameters	IAEA0848
SIGMA-1	Doppler broadening of ENDF/B lin lin interpolated point x-sec	IAEA0854
GROUPIE-92.1	Bondarenko self-shielded x-sec from ENDF/B	IAEA0849
FEDGROUP	group constant library from ENDF/B,KEDAK,UKNDL,JEF	IAEA0830
NJOY-91.38	general ENDF/B processing sys for reactor design problems	PSR-0171
TRANSX-2.0	n-gamma particle transport tables from MATXS format x-sec	PSR-0317
NSLINK	coupling of NJOY x-sec generation code to SCALE-3 sys	NEA 1347
MERGE-3.3	merge GENDF & CALENDF data for input to ECCO	NEA 1420
RMET21	n resonance self-shielding parameter calculations	IAEA1255

Table 2

INDEX TO NEW PROGRAMS

Program-name(s)	Description	Abstract
	ENSDF Processing	
ENSDF DELTA	gamma-gamma correlation analysis	USCD1149
ENSDF SPINOZA	tables of levels, decay, gammy-ray data from ENSDF	USCD1149
ENSDF GABS	absolute gamma-ray intensities from ENSDF data	USCD1149
ENSDF GAMUT	gamma-ray intensities & energies least square fits	USCD1149
ENSDF TREND	tabulation of ENSDF data	USCD1149
ENSDF FETCH	indexing of ENSDF files	USCD1149
ENSDF RADLIST	dose rates from nuclear decay data	USCD1149
ENSDF MEDLIST	dose rates from nuclear decay data	USCD1149
ENSDF RULER	reduced transition probabilities calculation	USCD1149
ENSDF PANDORA	physics checks on ENSDF data	USCD1149
ENSDF LOGFT	beta-decay log-ft & partial capture calculation	USCD1149
ENSDF HSICC	interpolation between Hager-Seltzer & Dragoun-Plajner-Schmutzler	USCD1149
ENSDF GTOL	least square fit of gamma spectra & level assignment	USCD1149
ENSDF FMTCHK	format checking program	USCD1149

Table 2 (cont)

NEA Evaluation Activities

A. JEF (Joint Evaluated File) project

Status of the JEF-2 Library

Following the release of the JEF-2.2 general purpose library in January 1992, the main efforts in this project have been devoted to benchmark testing of the data. Apart from calculations of simple critical experiments, carried out in several Member countries, more stringent testing was carried out at six national laboratories in Europe. The results obtained so far with JEF-2.2 in fast reactor calculations were comparable to those obtained with the current generation of "adjusted" data libraries, although more calculations are needed to draw firm conclusions concerning a few selected isotopes, especially the structural materials. Work is continuing on a wide variety of other validation calculations.

The testing of the JEF-2.2 Radioactive Decay and Fission Yield data are continuing, with a view to have a general release of these data in the spring of 1993.

General Release of the JEF-2 Library

Following a recommendation by the JEF Scientific Coordination Group, it was decided at the November 1992 meeting of the Nuclear Science Committee, that on the basis of test results to date, the JEF-2.2 library was suitable for distribution to scientists outside the OECD area, also in view of the extension of the International Evaluation Cooperation to include non-OECD member countries.

NJOY User Group

An NJOY user group was set up by the JEF Scientific Coordination Group (SCG) to:

- monitor and discuss changes required for processing correctly with NJOY the most recent evaluated nuclear data files, in particular JEF-2.
- ensure that quality assurance principles and procedures are adopted and used in maintaining NJOY and in processing evaluated data files, the main purpose being to avoid useless confusion or discussions as to where some of the inconsistencies and discrepancies between contributors in benchmarking come from and to speed up the benchmarking process of JEF/EFF.

Meetings are held regularly in connection with either the JEF coordination meetings or NJOY seminars. During these meetings it was decided to use NJOY-89.63 as the reference version for JEF-2 benchmarking. In parallel a working version should be kept for resolving processing problems that NJOY-89.63 cannot handle. This working version is now based on NJOY-91.38, which was distributed to all the user group members.

These meetings have allowed to identify nuclides having processing problems. It was recognised that most of these problems can be attributed to non strict compliance to the ENDF-6 format. Some minor problems in NJOY were identified, but in general it was concluded that NJOY is now performing well and provides satisfactory sets of processed data.

In developing and maintaining NJOY several basic quality assurance principles have been introduced. These are outlined in the NJOY user group notes. Among these, the need for a complete users manual was identified. Concrete actions have been started now in this respect and this

manual should be available in the near future. A library of typical test problems was set up, containing cases which have had problems in the past, which are representative of the wide range of evaluation styles and types. These test problems should be used for verifying that amendments to NJOY do indeed reproduce the correct results.

The next meeting will be held in connection with the JEF/EFF and International Evaluation Coordination meeting to be held next June in Cadarache.

Next Meeting

It was decided to hold the next meeting of the JEF Working Groups on Benchmark Testing, Data Processing and Evaluations on the 14th and 15th June 1993 at Cadarache, France. The JEF Scientific Coordination Group would meet on the 18th June 1992 also at Cadarache.

B. NEANSC International Evaluation Cooperation

The third meeting of the Working Party on International Evaluation Cooperation (IEC) was held at JAERI, Tokai-Mura, Japan, on 28th and 29th May 1992. Reports from the cooperating evaluation projects, ENDF, JEF/EFF and JENDL, were presented. Progress in the work of the following sub-groups was reviewed:

1. Inter-comparison of the files for ^{52}Cr, ^{56}Fe and ^{58}Ni.
2. Generation of covariance files for ^{56}Fe and ^{nat}Fe.
3. Actinide data in the thermal energy range.
4. ^{238}U capture and inelastic scattering cross sections.
5. ^{239}Pu 1--100 keV fission cross section.
6. Delayed neutron data benchmarking.
7. Multi-group cross section processing.
8. Minor Actinide Data.
9. High Priority Request List for Data Needs in Future/Advanced Reactors.
10. Fission Product Inelastic Scattering.
11. Inter-Comparison of the Resonance Region of ^{52}Cr, ^{56}Fe, and ^{58}Ni.

Recent Achievements

Two major achievements were reported at the last meeting of the Working Party:

1. Subgroup 3: A clear international consensus is emerging on these important data for applications. In particular the η shape of ^{235}U, of high relevance for present power moderator temperature coefficient assessment, has been established.
2. Subgroup 5: An outstanding discrepancy has been resolved and a new evaluation, which most probably will be used in all major evaluated nuclear data libraries has been performed.

In the field of *fission product data*, the present cooperative effort (subgroup 10) resulted in:

1. an initiative of a common validation process (JAERI, ANL, ECN-Petten and CEA-Cadarache) on a joint integral data base (the STEK and Rossendorf experiments), to converge on a recommendation on fission capture cross section data in the epithermal and high energy region
2. a recommendation for an NEANSC coordinated Interlaboratory Collaboration (ILC) on inelastic scattering measurements of a few of the major even-even nuclides. For these nuclides, conclusions have been dawn concerning the theoretical approach to be used in evaluations.

For Subgroup 4, the IEC has successfully produced a common view on the satisfactory status of the capture cross section (a long-standing problem of high relevance for reactor applications). In the case of the inelastic cross sections of this isotope, firm conclusions have not yet been drawn, but the existing discrepancies indicate a probable need of and ILC to reach a final understanding.

The review of the status of the subgroup 6 on *delayed neutron data validation* underlined the progress of the theoretical work, the relevance of planned or on-going coordinated microscopic experimental activities at Birmingham (UK), Studsvik (Sweden), and Dubna (Russia), and the progress in the preparation of the international integral experimental benchmark at MASURCA in Cadarache, France (to which seven laboratories will be contributing: CEA, JAERI, FEI-Obninsk, ENEA, AEA, KfK and LANL), in order to solve the present discrepancies on ^{238}U and ^{239}Pu data.

In summary, by October 1992, two subgroups will produce final statements, and four more subgroup activities will be completed by June 1993.

Future Trends

Two specific fields, *minor actinides* and *structural materials*, will be the focus of future specific international cooperative efforts, according to the findings of the inter-comparison work of three subgroups (1, 8 and 11).

The discussions held at the last Working Party meeting indicated two new fields for future activity:

1. The assessment of the criteria and quality standards for evaluation acceptability. The goal is to establish the standards required for a possible converge of the existing evaluated data files.
2. High energy data. The new field of application of accelerators of high energy particles (in particular for long lived radioactive waste transmutation), will require the assembly of the relevant nuclear data. The IEC will act in coordination and according to the results of on-going studies launched by the NSC. A more detailed programme will be discussed at the next meeting of the Working Party.

Relation with other projects of the NSC

The Working Party will establish a high priority request list as part of a subgroup activity, according to the final report that will be issued by the Working Party on "Review of Data Needs in the 90's and the Data Centres Network". Concerning the ILC on Experimental Activities, the Working Party will keep close contact with the responsible, Dr. A. Deruytter, to insure the coordination between experimental requirements resulting from the subgroup findings and available experimental resources.

Relation with non-OECD countries

A proposal for a revision of membership was discussed and approved by the NEA Nuclear Science Committee in 1992.

Next Meeting

The Working Party agreed to meet in June 1993 in Cadarache, France, in conjunction with the planned JEF and EFF technical meetings, to allow US and Japanese specialists to participate also to these meetings and to review at the same time specific subgroup activities.

DISTRIBUTION LIST FOR OECD AND IAEA MEMBER COUNTRIES

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AUSTRALIA	J. Boldeman
AUSTRIA	G. Sonneck, H. Vonach
BANGLADESH	M.A. Mannan
BELARUS	A.B. Klepatskij, V.P. Korennoj
BRAZIL	L.T. Auler, R. Paviotti Corcuera, S. de Queiroz Bogado Leite
BULGARIA	N. Janeva
CANADA	W.B. Lewis
CHINA (PEOPLE'S REP.)	Bao Shanglien, Cai Dunjiu, Huo Yu-kun, Le Junchu, Li Yesha, Wang Dao, Wang Gongqing, Yu Zi-Qiang, Zhou Yongyi
DENMARK	E. Nonbol
EURATOM	K.H. Boeckhoff, H. Rief, G. Rohr, E. Wattercamps, H. Weigmann
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FINLAND	F. Wasastjerna
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