International Atomic Energy Agency

INDC(NDS)-304
Distr. G, P

INDC INTERNATIONAL NUCLEAR DATA COMMITTEE

PROGRESS

IN

FISSION PRODUCT NUCLEAR DATA

Information about
activities and requirements
in the field of measurements and compilations/evaluations
of fission product nuclear data (FPND)

Collected by M. Lammer

Nuclear Data Section
International Atomic Energy Agency
Vienna, Austria

No. 14

1994

IAEA NUCLEAR DATA SECTION, WAGRAMERSTRASSE 5, A-1400 VIENNA

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TABLE OF CONTENTS

Page numbers in brackets refer to collaborations, which are not listed under "Laboratory and Address".

FOREWORD

This is the 14th issue of a report series on Fission Product Nuclear Data (FPND) which is published by the Nuclear Data Section (NDS) of the International Atomic Energy Agency (IAEA). The purpose of this series is to inform scientists working on FPND, or using such data, about all activities in this field which are planned, ongoing, or have recently been completed.

The types of activities included in this report are measurements, compilations and evaluations of:

Fission product **yields** (neutron induced and spontaneous fission);
Neutron reaction **cross sections** of fission products;
Data related to the radioactive **decay** of fission products;
Delayed neutron data from neutron induced and spontaneous fission;
Lumped fission product data (decay heat, absorption etc.).

The **first part** of this report consists of unaltered original contributions which the authors have sent to IAEA/NDS. Therefore, the IAEA cannot be held responsible for the information contained nor for any consequences resulting from the use of this information. Contributions containing information on the data types given above are accepted. Contributions on experimental work can usually be included repeatedly until the final publication is presented. Contributions on evaluations continue to be included as long as the data or files are not superseded.

The **second part** contains some recent references relative to fission product nuclear data, which were not covered by the contributions submitted, and selected papers from conferences. However, completeness of literature citations in this part is not attempted.

NOTE:

Part 3 contains requirements for **further FPND measurements** (see also "Note to Measurers" on page x), which were recommended by participants in the IAEA Coordinated Research Programme on the Compilation and Evaluation of Fission Yield Nuclear Data.

The 13th issue of this series has been published in November 1990 as INDC(NDS)-222. The present issue includes contributions which were received by NDS between October 1990 and 15 April 1994.

The next issue of this report series is envisaged to be published in 1996.

SUBMITTING CONTRIBUTIONS

The next issue is expected to be published in mid 1996. All scientists who are presently working - or have recently completed work - in the field of FPND and who want to contribute to the next issue of this series are kindly asked to send contributions to me between now and May 1996.

Those scientists or groups who have already contributed to the present issue and who want to leave their contribution(s) unchanged or who wish to suggest only slight changes, should inform me accordingly before the above deadline.

FORMAT:

The size of one contribution should preferably not exceed one page. Of course, the number of contributions per working group or laboratory is not restricted. Similar experiments (calculations, compilations, evaluations) performed by one person or group should preferably be combined into one contribution, if this is possible without loss of clarity.

The **headings** suggested for the 3 types of contributions are shown on the following page. For the sake of consistency it is requested that the suggested headings be used as far as appropriate.

COMPILATIONS and EVALUATIONS: If applicable, the availability of numerical data from computer files could be indicated either under the heading "Computer files ..." or under a separate heading "Availability".

CONTACT: If desired, the name of the person to be contacted for further information or numerical data, or customer services in the case of data files, can be given.

EDITING: Since contributions received are generally used directly for publication, it is important that **typed ORIGINALS** are sent and not just carbon- or photocopies. It would be a great help for producing an edited report if a margin of 2 cm (or 1 inch for North American paper format) is left on each side of the text, and a 5 cm space is left at the top of each page (or 3 cm if the name of the country is included).

COMMENTS or SUGGESTIONS concerning the format, contents and layout of this report series are most welcome and should be directed to me in time before the next issue.

I would like to thank the contributors for their cooperation.

Meinhart Lammer

Suggested headings, if appropriate, for:

Measurements:	Compilations:	Evaluations:
Laboratory and address:	Laboratory and address:	Laboratory and address:
Names:	Names:	Names:
Facilities:		
EXPERIMENT:	COMPILATION:	EVALUATION:
Method:		Method:
Completion date:	Major sources of information:	Major sources of information:
Results:	Deadline of literature coverage:	Deadline of literature coverage:
Discrepances to other reported data:	Cooperation:	Status:
Contact:	Other relevant details:	Cooperation:
Publications:	Computer file:	Other relevant details:
	Availability:	Computer file of compiled data:
	Completion date:	Computer file of evaluated data:
	Contact:	Availability:
	Publications:	Discrepancies encountered:
		Completion date:
		Contact:
		Publications:

NOTE TO MEASURES

Participants of an **IAEA Coordinated Research Programme (CRP) on the "Compilation and Evaluation of Fission Yield Nuclear Data"** (see also Part 3) issued several recommendations and requests of relevance to measurers, which are summarized below:

1) **EXFOR** (EXchange FORmat) will be commonly used as the format and data base for the compilation and exchange of experimental fission yield data. It provides for the inclusion of detailed information on the experimental conditions and data analysis. Authors of papers which are compiled into EXFOR receive copies of the entries for proof-reading, which makes an EXFOR entry a publication which can be cited. Therefore it is essential that **measurers respond to author proofs** and exprimental details requested by the compiler.

2) Special care should be taken by **measurers of independent yields** to take into account isomeric yields and branching fractions for decay and delayed neutron emission, and the numerical values used should be given. It should be clearly stated whether the data are before or after delayed neutron emission. Measurers are urgently requested to publish sufficient details on the method used, and how these data were used in the analysis.

3) **Publication of uncertainties and experimental details:**
Measurers should publish all contributions to the overall uncertainty in detail, i.e.: statistical error, systematic error contributions (determined or estimated), correlations and covariances (or at least estimates of correlation coefficients). Furthermore, sufficient details on the experiments, results, data and error analyses should be given which are pertinent for the data evaluation. If journal editors do not accept such lengthy descriptions of the experiments, the relevant details can be either

   - published in a laboratory report, or
   - communicated directly to evaluators. In any case should they be
   - provided to the EXFOR compiler for inclusion in the entry.

   This should also be done if errors in the data are detected or data are withdrawn by measurers.

4) Further **measurements** of fission yields are **still needed** as given in more detail in Part 3 of this issue. The tables of individual yields required are given in the **Suppelement to WRENDA 93/94, INDC(SEC)-105**. In summary, the following types of data are requested, generally as function of incident neutron ennergy and fissioning nuclide:

   - ternary fission yields,
   - chain yields with no measurement, only one measurement, or discrepant measurements,
   - independent yields (isobaric, isotopic),
   - isomeric yields and yield ratios,
   - all types of yields in the symmetric and far asymmetric region,
   - systematic studies of odd-even effects, of distributions of mass, charge and kinetic energy, for the improvement of model parameters.

   Regarding the chain yields, measurers are asked to look at the tables of discrepancies in INDC(SEC)-105, look at their own measurements and analyse the data.

SUBJECT INDEX

With respect to the earlier issues, underlined page numbers refer to new work, page numbers in brackets refer to unchanged contributions, and others refer to revised contributions.

1. MEASUREMENTS

1.1. *Fission yields*

1.1. *Fission yields (cont'd)*

1.2. *Neutron reaction cross sections*

nuclide	neutron energy	further specifications	page
Tc- 99	thermal	capture σ	48
	pile	integral reactivity test	27
Ru	pile	integral reactivity test	27
Rh-103	pile	integr.: absorpt.,capt.,scatt. effect	26
	pile	integral reactivity test	27
	fast	unspecified	74
Pd	up to 3 MeV	inelastic	7
	0.6-4.5 MeV	total	74
	1.5-10 MeV	diff. elastic+inelastic	74
Pd-105	pile	integr.: absorpt.,capt.,scatt. effect	26
Ag	pile	integral reactivity test	27
Ag-109	pile	integr.: absorpt.,capt.,scatt. effect	26
	pile	integral reactivity test	27
Cd	pile	integr.: absorpt.,capt.,scatt. effect	26
	1.5-10 MeV	differential inelastic	74
Cd-114	14.6 MeV	(n,d)+(n,np)+(n,pn)	72
Sn	fast	unspecified	74
Sn-112	14.6 MeV	(n,p),(n,α),(n,d)+(n,np)+(n,pn)	69
Sn-114	14.6 MeV	(n,p),(n,α,(n,d)+(n,np)+(n,pn)	69
Sn-116	14.6 MeV	(n,p),(n,α),(n,d)+(n,np)+(n,pn)	69
Sn-118	14.6 MeV	(n,p),(n,α),(n,d)+(n,np)+(n,pn)	69
Sn-120	14.6 MeV	(n,p),(n,α),(n,d)+(n,np)+(n,pn)	69
Sn-122	14.6 MeV	(n,p),(n,α),(n,d)+(n,np)+(n,pn)	69
Sn-124	14.6 MeV	(n,p),(n,α),(n,d)+(n,np)+(n,pn)	69
Sb	fast	unspecified	74
Sb-121	below 600 eV	resonance parameters	44
Sb-123	below 1.3 keV	resonance parameters	44
Te-122	14.6 MeV	(n,p) partial	70
	14.6 MeV	(n,p) partial	70

1.2. *Neutron reaction cross sections (cont'd)*

1.2. *Neutron reaction cross sections (cont'd)*

FProd = gross FP-mixtures

Many = several nuclides not specified in detail

1.3. *Decay data*

1.3. *Decay data (cont'd)*

1.3. *Decay data (cont'd)*

1.3. *Decay data (cont'd)*

A = several nuclides within the mass chain given

Many = several nuclides not specified in detail

1.4. *Delayed neutron (=dn) data*

2. COMPILATIONS AND EVALUATIONS

data category	further specifications	page
fission yields	compil.+eval.,10 fission systems complet	83
	charge distr.,U-236,Cf-252 spont. fissio	84
	compilation (JNDC) for decay heat calc.	86
	isomeric yield ratios: new model	91
	evaluation:indep. yields, Pu-239 thermal	92
	complete eval., indep.+ cumul., UKFY3	94
	eval. file (ENDF/B-VI), 60 yield sets	97
	indep. yields, charge distribution	102
cross sections	evaluation: 172 FP (Z=33-65) for JENDL-3	87
	integral test of JENDL FP libraries	87
	evaluated file for natural cadmium	96
decay data	Nuclear Data Sheets,6 A-Chains:A=102-112	82
	compil.+eval. (JNDC) for decay heat calc	86
	absolute γ branching ratios, A=74-165	91
	UK fission product decay data file	93
	eval. file in ENDF/B-VI format,979 nucl.	97
delayed neutrons	compilation (JNDC) for decay heat calc.	86
	Pn-values for about 100 precursors	90
	delayed neutron spectra: 270 precursors	97
decay heat	summation calculation, JNDC working group	86

PART 1: ORIGINAL CONTRIBUTIONS

1.1 MEASUREMENTS

BELGIUM

Laboratories and adresses	:	Nuclear Physics Laboratory Proeftuinstraat, 86, B-9000 Gent, Belgium Institut Laue-Langevin, B.P. 156 X, F-38042 Grenoble, France
Names	:	C. Wagemans, P. Geltenbort
Facilities	:	High Flux Reactor, Institut Laue-Langevin, Grenoble
Experiments	:	Thermal neutron induced (n,α) and (n,p) reactions on fission products.
Method	:	Charged particle detection with surface barrier detectors and surface barrier telescope (ΔE-E) detectors.
Completion date	:	Systematic study in progress
Publications	:	C. Wagemans et al., Proc. Int. Symp. Nuclei in the Cosmos, Baden/Vienna (Austria), 1990, 296.

BELGIUM

Laboratories and adresses	:	Nuclear Physics Laboratory Proeftuinstraat, 86, B-9000 Gent, Belgium Institut Laue-Langevin, B.P. 156 X, F-38042 Grenoble, France
Names	:	C. Wagemans, P. Geltenbort
Facilities	:	High Flux Reactor , Institut Laue-Langevin, Grenoble
Experiments	:	Absolute yields and energy distributions of the charged light particles emitted during thermal neutron induced fission.
Method	:	The charged particles are identified with surface barrier (ΔE-E) telescope detectors.
Publications	:	1) C. Wagemans "Ternary fission" in The Nuclear Fission Process, Chapter 12, p. 545, CRC Press (USA), C. Wagemans (editor), 1991. 2) C. Wagemans, Proc. Int. Workshop on Dynamical Aspects of Nuclear Fission, Smolenice (CSFR), 1991, p. 139.

E.E.C. BELGIUM

Laboratories and adresses : CEC-JRC, Institute for Reference Materials and Measurements, B-2440 Geel, Belgium

SCK/CEN, B-2400 Mol, Belgium

Names : C. Wagemans, L. Demattè, P. D'hondt, A.J. Deruytter

Facilities : Thermal neutron beam at the Reactor BR1

Experiments : Fission fragment kinetic energy and mass distributions for $^{236}Pu(s.f.)$, $^{238}Pu(s.f.)$, $^{239}Pu(n_{th},f)$, $^{240}Pu(s.f.)$, $^{242}Pu(s.f.)$ and $^{244}Pu(s.f.)$

Method : Coincident fission fragments detected with surface barrier detectors. Deduced fragment mass and energy distributions.

Publications :

1) C. Wagemans et al., Nucl. Phys. A502 (1989) 287c.

2) P. Schillebeeckx et al., Nucl. Phys. A545 (1992) 623.

3) C. Wagemans et al., Proc. 2nd. Int. Conf. on Dynamical Aspects of Nuclear Fission, Smolenice (Slovakia), 1993, in print.

E.E.C. BELGIUM

Laboratories and adresses	:	CEC-JRC, Institute for Reference Materials and Measurements, B-2440 Geel, Belgium Nuclear Physics Laboratory, Proeftuinstraat 86, B-9000 Gent, Belgium
Names	:	C. Wagemans, S. Pommé
Facilities	:	Neutron time-of-flight spectrometer at the 150 MeV linac GELINA.
Experiments	:	Yields and energy distributions of the ternary alpha's and tritons for spontaneously fissioning Pu-isotopes and in the $^{235}U(n,f)$ and $^{239}Pu(n,f)$ resonances.
Method	:	The charged particles are identified with ΔE (ionization chamber)-E(surface barrier) telescope detectors.

BELGIUM

Laboratory and address : CEC-JRC, Institute for Reference Materials and Measurements (IRMM), B-2440 Geel, Belgium

1) Names : F.-J. Hambsch, P. Siegler

Facilities : Neutron time-of-flight spectrometer GELINA, 7MV and 3,7 MV Van de Graaff

Experiment : Fission fragment total kinetic energy and mass distribution for ^{237}Np (n,f) from 0.3 MeV to 5.5 MeV incident neutron energy.

Method : Twin Frisch gridded ionization chamber for coincident fission fragment detection.

Accuracy : Fragment mass resolution about 2 u. Fragment energy resolution about 2 MeV, $2 \cdot 10^5$ coincident events recorded.

Completion date : Data evaluation and interpretation still ongoing.

Publications : SIEGLER, P., HAMBSCH, F.-J., THEOBALD, J.P. and VAN AARLE, J.
: Recent fission investigations at IRMM
Proc. 2nd Int. Conf. on Dynamical Aspects of Nuclear Fission, 14-18.6.93, Smolenice, Slovakia

2) Names : F.-J. Hambsch, J. Van Aarle

Facilities : Neutron time-of-flight spectrometer GELINA, 7MV and 3.7 MV Van de Graaff.

Experiment : Fission fragment total kinetic energy, mass and angular distributions of ^{252}Cf(sf) in correlation with prompt gamma emission.

Method : Twin Frisch gridded ionization chamber for coincident fission fragment detection. HP-Ge detector for gamma detection.

Accuracy : Fragment mass resolution better than 1 u. Fragment energy resolution about 0.5 MeV.

Completion date : Data evaluation as well as data acquisition still ongoing.

Publications : None at present

E.E.C. Belgium

Laboratory and address: IRMM Joint Research Centre
Van de Graaff Laboratory
Retieseweg, 2440 Geel, Belgium
Tel +32-(0)14-571 211, Telex 33589 EURAT B
Fax +32-(0)14-584 273

Names: A.Meister (visiting scientist) and E.Wattecamps

Facility: 7 MV Van de Graaff laboratory

Experiment: neutron cross section measurement for Pd(n,n'γ) from threshold to 3 MeV

Method: gamma ray emission cross section of single lines, time-of-flight thick Be Li (p,n) target, " white source", high purity Ge gamma ray detector, multi-parameter acquisition and analysis, cross section measured relative to $^{10}B(n,n'\gamma)$ and relative to proton recoil.

Accuracy: attempt for approximately 10% for first levels foreground to background ratio satisfactory, counting rate foreground sufficient.

Completion date: data acquisition of run of 100 hours is completed, emission rate for lowest level is determined, analysis further levels is in progress

Discrepancies to other reported data:

Publications : IRMM annual programme progress report 1993, to be released April 1994

Paper submitted to the Int.Conf. on Nuclear Data for Science and Technology, Gatlingburg, USA, 9 - 13/5/1994

E.E.C. Belgium

Laboratory and address: IRMM Joint Research Centre
Retieseweg, 2440 Geel, Belgium
Tel. : 32. (0) 14-571 211 Telex 33589 Eurat B
Fax: 32. (0) 14-584 273

Names: F. Corvi and H. Beer (visiting scientist)

Facility: 140 MeV Electron Linac

Experiment: neutron capture cross section of ^{138}Ba from thermal up to 200 keV

Method: C_6D_6-based liquid scintillators and the pulse-height weighting method.

Completion date: 1.09.1993

Discrepancies to other reported data: see A.R. de Musgrove et al., Aust. J. Phys. 32 (1979) 213

Publications:

1. H. Beer, F. Corvi, A. Mauri and K. Athanassopulos, in Nuclei in the Cosmos (Inst. of Phys. Pub., London 1993) p. 227

2. H. Beer, F. Corvi and K. Athanassopulos, Proc. 8th. Int. Symp. on Capture Gamma-Ray Spectroscopy (Fribourg, 20-24 Sept. 1993)

BRAZIL

Laboratory and address:	Instituto de Engenharia Nuclear Comissão Nacional de Energia Nuclear Caixa Postal 68.550 21945-970, Rio de Janeiro, Brasil
Names:	A.V. Bellido, S.C. Cabral
Facilities:	CV-28 Variable Energy Cyclotron Helium Jet Transport System.
Experiment	Fission yield determinations and decay scheme investigations on short-lived fission products from actinides fissioned by charged particles.
Method:	Quick transport by a heluim jet of the recoiling fission products from the irradiation chamber to the collection chamber (at 15 m distance) and then to the counting station situated just in front of a high resolution Ge(Li) detector. Identification and measurement of the fission products by gamma-ray spectrometry.
Accuracy:	Better than 10%.
Completion date:	The work is on progress.
Publications:	A.V. Bellido, "Methodology and experimental setup for the short-lived fission product yields measurements in fission induced by charged particles". IEN, Dec. 1993.

CANADA

Laboratory and Address:	AECL Research Chalk River Laboratories, Chalk River, Ontario, Canada K0J 1J0
Names:	R.H. Martin
Facilities:	1) $4\pi\gamma$ ionization chamber 2) Ge spectrometer
EXPERIMENT:	Half-lives of ^{109}Cd, ^{133}Ba, ^{144}Ce and ^{152}Eu
Method:	$4\pi\gamma$ ionization chamber.
Accuracy:	<0.1%
Completion Date:	1994 April
Discrepancies to other data:	None at present.
Publication:	To be published

CANADA

Laboratory and Address:	AECL Research Chalk River Laboratories, Chalk River, Ontario, Canada K0J 1J0
Names:	R.H. Martin, K.I.W. Burns and J.G.V. Taylor
Facilities:	1) $4\pi\beta$ gas flow proportional counter 2) Ge detector
<u>EXPERIMENT</u>:	The half-life of ^{90}Sr was determined at 10561 days.
Method:	$4\pi\beta$ gas flow proportional counter
Accuracy:	± 14 days (0.13%).
Completion Date:	Work is completed and the report is in publication.
Discrepancies to other data:	This value supports the value recommended by Rajput and MacMahon in Nucl. Instr. and Meth. 312 (1992) 289, and is in agreement with all but two of previously-reported measurements.
Publication:	Nuclear Instruments and Methods in Physics Research Section A (number not issued yet).

CANADA

Laboratory and Address:	AECL Research Chalk River Laboratories, Chalk River, Ontario, Canada K0J 1J0
Names:	R.H. Martin and J.G.V. Taylor
Facilities:	1) $4\pi\gamma$ ionization chamber 4) Ge spectrometer
EXPERIMENT:	The half-life of ^{137}Cs has been found to be 10967.8 days. A purified source of ^{137}Cs was measured in an ionization chamber for eight years relative to three ^{226}Ra reference sources. Allowance was made in the least squares fitting procedure for a small contribution from ^{134}Cs (0.027% initially) and for ^{210}Bi growing towards equilibrium in the reference sources.
Method:	$4\pi\gamma$ ionization chamber.
Accuracy:	± 4.5 days (0.04%). This uncertainty combines Type A and Type B components equivalent to one standard deviation.
Completion Date:	Work is complete and a report has been published.
Discrepancies to other data:	More than 20 measurements of the ^{137}Cs half-life have been reported since its discovery. Twenty-one values range from 9715 to 12053 days. The weighted mean of these 21 values is 10988 ± 22 (external error) days with a reduced chi-squared of 13. Within the uncertainties so calculated, this new result agrees with the average of previously reported values.
Publication:	Published in Nuclear Instruments & Methods A286(3) as part of the proceedings of the 1989 ICRM International Symposium on Nuclear Decay Data.

CANADA

Laboratory and Address:	AECL Research Chalk River Laboratories, Chalk River, Ontario, Canada K0J 1J0
Names:	R.H. Martin and N.A. Keller
Facilities:	Calibrated Ge detector
EXPERIMENT:	The emission probabilities of the 161-, 303- and 384-keV γ-rays in the decay of ^{133}Xe have been measured and found to be (2.42±0.25) x 10^{-3}, (1.93±0.07) x 10^{-4} and (9.0±0.4) x 10^{-5} relative to the sum of the 80- and 81-keV γ rays.
Method:	Standard sources of ^{133}Ba and a calibrated Ge spectrometer was used to measure the γ-ray emission rates from an ampoule of ^{133}Xe gas. Corrections were made for differences in geometry, summing, random losses, attenuation and radioactive decay.
Accuracy:	From 3.6% to 10.3%. This uncertainty combines Type A and Type B components equivalent to one standard deviation.
Completion Date:	Completed and report published.
Discrepancies to other data:	In general, the results do not agree with previously-published results.
Publication:	Published in Applied Radiation & Isotopes, Volume 43, Number 3, as "A Measurement of the Photon Emission Probabilities for the 161-, 303- and 384-keV γ-ray lines in the Decay of ^{133}Xe".

CANADA

Laboratory and Address:	AECL Research Chalk River Laboratories, Chalk River, Ontario, Canada K0J 1J0
Names:	*R.H. Martin*
Facilities:	1) $4\pi\beta$-γ coincidence system 2) Ge detector
EXPERIMENT:	The emission probability of the 121-keV γ-ray in the decay of ^{147}Pm has been measured by Ge spectrometry of standardized sources. The value found was $(2.713\pm0.014) \times 10^{-5}$.
Method:	A solution of ^{147}Pm was standardized by efficiency tracing with ^{60}Co using a $4\pi\beta\gamma$ coincidence counting system. Sources were prepared from the standardized solution. A calibrated Ge spectrometer was used to measure the 121-keV γ-ray emission rate.
Accuracy:	± 0.5%. This uncertainty combines Type A and Type B components equivalent to one standard deviation.
Completion Date:	Work has been completed and a draft report has been written.
Discrepancies to other data:	Seven measurements of this emission probability have been reported in the literature. The weighted mean of six of these values (one experiment did not find the γ-ray) is $(2.96\pm0.20) \times 10^{-6}$ where the uncertainty is the external error in the weighted mean. The present result agrees reasonably well with the mean of reported values.
Publication:	To be published.

CANDADA

Laboratory and Address:	AECL Research Chalk River Laboratories, Chalk River, Ontario, Canada K0J 1J0
Names:	K.I.W. Burns and R.H. Martin
Facilities:	Calibrated Ge detector, mass spectrometer
EXPERIMENT:	Measure the half-life of ^{94}Nb.
Method:	Measure the specific activity of a solution using Ge spectrometry and isotope dilution mass spectrometry.
Accuracy:	<10%.
Completion Date:	Undetermined at present.
Discrepancies to other data:	None at present.
Publication:	No publication at present.

CANADA

Institute	A.E.C.L., Chalk River, Ontario, Canada
Reference	Nucl. Inst. & Methods in Physics Research A332(1993)232
Author	M.A. LONE, W.J. EDWARDS, R. COLLINS
Title	Measurements of the Thermal Neutron Cross Section of $^{90}Sr(n,\gamma)$ Reaction
Facility	REACTOR NRU D20 moderated reactor
Inc. Part. Source	Hydraulic Capsule Facility
Incident Spectrum	Cd ratio for cobalt about 30
Sample	1 mCi purified ^{90}Sr sealed in quartz
Method	(ACTIVATION) (CHEMICAL SEPARATION) Y chemically separated from Sr before irradiation and after irradiation but prior to counting ^{91}Sr activity
Detector	(GERMANIUM INTRINSIC DETECTOR) High resolution Ge spectrometer Detector efficiency determined using set of calibrated ^{137}Cs, ^{134}Cs, ^{133}Ba, ^{88}Y, ^{60}Co, and ^{54}Mn sources Amount of ^{90}Sr in sample determined from beta activity of ^{90}Y using end-window proportional counter
Decay Data	^{91}Sr half-life = 9.48 HR, DECAY GAMMAS : 555.56 KeV, ABUND = 0.615 849.72 KeV, ABUND = 0.236 1024.28 KeV, ABUND = 0.33 Branching ratios taken from Browne & Firestone, 'Table of Radioactive Isotopes' (1986)
Standard	$^{59}Co(n,\gamma)^{60}Co$, SIG,k,MXW) Co/Al alloy flux monitor
Analysis	Average value 9.7 ± 0.7 mb from three runs and for three gammas measured. Averages for three gammas: 9.2mb (555 keV), 10.3mb (749keV), 9.6mb (1024keV)
Corrections	decay during counting period, and secular equilibrium of the 556 keV transition from 49.7 min ^{41}Y
Error Analysis	(DATA-ERR) Total rms uncertainty Includes uncertainties due to: - contamination of the ^{90}Sr by fissionable material - weighing uncertainties - volumetric uncertainties - gamma measurement and gamma calibration uncertainties - gamma branching ratio uncertainties - beta - calibrations and measurements

CHINA

Laboratory And Address:	*Laboratory of Nuclear Chemistry* *China Institute of Atomic Energy* *P.O. Box 275, Beijing 102413, China*
Names:	*Qi Linkun, Liu Conggui, Su Shuxin, Liu Yonghui, Li Ze, Cui Anzhi, Guo Jingru*
Faclities:	*Heavy Water Research Reactor* *High resolution Ge(Li) gamma-ray Spectrometric System* *Low Background beta counting system*
Experiment:	*The mass distribution of fission of U-235 and U-238 induced by the fission spectrum neutrons*
Methods:	*Radiochemical method and Ge(Li) gamma ray spectroscopy*
Accuracy:	*3—50% for U-235* *3—30% for U-238*
Completion Date:	*July 1986(U-235)* *July 1988(U-238)*
Publications:	*1. Qi Linkun, Liu Conggui, Li Ze, Wang Xiuzhi, Zhang Sujing, Liu Yonghui, Liu Daming, Ju Changxin ,Lu Huijun, Zhu Jiaxian, Guo Jingru. The Mass Distribution in Fission Spectrum Neutron Induced Fission of U-235, Proceedings of the International Conference " Nuclear Data for Science and Technology ", May 30—June 3, 1988, Mito, Japan, P.967* *2. Su Shuxin, Liu Yonghui, Zhang Sujing, Liu Conggui, Wang Xiuzhi, Qi Dahai, Tang Peijia. The Mass Distribution in Fission Spectrum Neutron Induced Fission of U-238, Chin. J. Nucl. Radiochem. 13(1991), 129*

C H I N A

Laboratory And Address:	*Laboratory of Nuclear Chemistry China Institute of Atomic Energy P.O. Box 275, Beijing 102413, China*
Names:	*Wang Dungmei, Zhang Chunhua, Tang Peijia, Liu Daming, Guo Jingru, Wang Fangding*
Facilities:	*Swimming pool reactor Fe-Al-S filter Low background beta counting system.*
Experiment:	*Measurement of fission yields of Mo-99, Te-132 and Ba-140 from U-235 fission induced by 24.4keV neutrons.*
Methods:	*24.4keV filtered neutron beam from a Fe-Al-S filter in swimming reactor; Polycarbonate film as a fission track recorder; Radiochemical separatoin; Low background beta counting.*
Accuracy:	*About 5%*
Completion date:	*July 1989*
Publications:	*Wang Dungmei et al., Measurement of Fission Yields from U-235 Fission Induced by 24.4 keV Neutrons. Chin. J. Nucl. Radiochem., 13(4), 237(1991)*

CHINA

Laboratory and Address:	China Institute of Atomic Energy P. O. Box 275(48), Beijing 102413, P. R. China
Names:	Li Ze, Wang Xiuzhi, Jing Kexing, Cui Anzhi, Liu Daming, Li Daming, Liu Yonghui, Li Xueliang, Liu Conggui, Su Shuxing, Tang Peijia, Chih Tahai, Zhang Shulan, Zhang Shengdong and Guo Jingru
Facilities:	Tandem accelerator Ge(Li) and HPGe gamma ray spectrometric systems. Low background measurement system.
Experiment:	Fission product yields for 40 mass chains were determined for the fission of ^{238}U induced by 11.3 MeV neutrons for the first time. Absolute fission rate was monitored with a double-fission chamber. Fission product activities were measured by HPGe or Ge(Li) γ-ray spectrometry of irradistion ^{238}U foils and by chemical separation of the fission product elements followed by β-counting and/or γ-ray spectrometry. Time of flight technique was used to measured the neutron spectrum in order to estimate the fission events induced by break-up neutrons and scattering neutrons. A complete mass distribution curve has been obtained and the dependence of fission yield with neutron energy is discussed.
Methods:	Radiochemical method and gamma ray spectroscopy method.
Accuracy:	3.5-30%.
Completion date:	December 1990.
Publications:	Li Ze, Wang Xiuzhi, Jing Kexing, Cui Anzhi, Liu Daming, Li Daming, Liu Yonghui, Li Xueliang, Liu Conggui, Su Shuxing, Tang Peijia, Chih Tahai, Zhang Shulan, Zhang Shengdong andGuo Jingru. Radiochimica Acta (to be published)

CHINA

Laboratory and address:	Nuclear Physics Laboratory, Physics Department, Jilin University, Changchun 130023, P.R. of China.
Names:	Liu Yunzuo, Hu Dailing, Sun Huibin, Huo Junde, Ma Chunhei, Ma Yingjun, Ma Yugang.
Facilities:	Coaxial Ge(Li) detectors of 105 cm^3 and 110 cm^3, coaxial HpGe detector of 114 cm^3, planar HpGe detectors of 1 $cm^2 \times 1$ cm and 10 $cm^2 \times 1.5$ cm, Si(Li) detector of 1 $cm^2 \times 1$ cm. 4K and 8K multichannel analyzers, multiparameter system, angular correlation set-up, fast-slow coincidence system. PDP 11/23, PDP 11/44, and PC 486 computer systems.
Experiment:	Studies on levels populated in beta-decay of various nuclides at higher resolution and improved counting statistics; Measurements of energies and intensities of gamma rays emitted by nuclides related to nuclear energy utilization.
Method:	Gamma singles and gamma-gamma coincidence measurements.
Completion data:	Published: decay of ^{147}Nd, ^{140}La, ^{124}Sb, ^{192}Ir, ^{131}Ba, ^{182}Ta and ^{152}Eu.
Publications:	1.Study on the Decay Scheme of ^{147}Nd Chinese Journal of Nuclear Physics, 5, 313(1983). 2.Level Structure of ^{140}Ce from the Decay of ^{140}La. Chinese Physics Letters, 2, 265(1985). 3.Studies on the Low-lying Levels in ^{192}Pt and ^{192}Os Populated in the ^{192}Ir Decay Z.Phys. A-Atomic Nuclei, 329, 307-317(1988). 4.Levels in ^{124}Te Populated in the Decay of ^{124}Sb. Z.Phys. A-Atomic Nuclei, 331, 391-400(1988). 5.Study of the Decay of ^{131}Ba. Z.Phys. A-Atomic Nuclei, 336, 37(1990). 6.Levels in ^{182}W Populated in the Decay of ^{182}Ta. Z.Phys. A-Atomic Nuclei 342, 141(1992). 7.On the Newly Proposed Levels in ^{152}Gd and ^{152}Sm. Z.Phys. A-Hadrons and Nuclei, 334, 25(1992). 8.On Some New Levels in ^{182}W. J.Phys. G: Nuclear and Particle Physics, 19, 213(1993).

China

Laboratory and Address:
Institute of Nuclear Science and Technology of Sichuan University

Name:
Xu Haishan Xiang Zhengyu Mu Yunshan Li Yexiang Liu Jianfeng
Wang Shiming Chen Yaoshun Liu Jinrong

Facilities:
Pulsed 2.5 MeV Van de Graaff,
Large liquid scintillator tank.

Research:
We have measured the fast neutron capture cross sections, using a prompt detection technique, for fission products Nd, Sm, Eu, Tb, Dy, Er, Tm, Hf, W and Yb in the 0.4-1.6 MeV neutron energy rangy. Relative cross sections have been determined by Au-197 as a standard sample.The neutron capture cross sections were calculated from 0.1-2.0 MeV using an optical model and statistical theory.

Accuracy:
10-12%

Completion date:
1990

Published:
Chinese Journal of Nuclear Techniques, 9, 9 (1986)
Chinese Journal of Nuclear Physics, 9, 2, 39 (1987)
Chinese Journal of Nuclear Physics, 10, 3, 233 (1988)
Chinese Journal of Nuclear Techniques, 12, 4, 237(1989)
International Conference on Nuclear Data for Science and Technology (1988 MITO) 803-805,
International Conference on Nuclear Data for Science and Technology (1991 Jülich) 367-369,
Nuclear Science and Engineering, 104,277-279(1990)

China

Laboratory and Address:

Institute of Nuclear Science and Technology of Sichuan University

Name:

Mu Yunshan Xu Haishan Xiang Zhengyu Li Yexiang Liu Jianfeng Wang Shiming

Facilities:

Pulsed 2.5 MeV Van de Graaff,
Large liquid scintillator tank.

Research:

We have measured the fast neutron capture cross sections of fission products Nb and Mo, using the technique of detection of prompt gamma rays in the 0.7-1.4 MeV neutron energy rangy. Relative cross sections have been determined by Au-197 as a standard sample.The neutron capture cross sections from 0.5 to 2.0 MeV for Nb and from 0.01 to 2.0 MeV for Mo are calculated using the optical model and statistical theory.

Accuracy:

11-12%

Completion date:

1990

Published:

Nuclear Science and Engineering, 108, 302-307 (1991)
Chinese Journal of High Energy Physics and Nuclear Physics 15, 1, 66(1991)

EGYPT

Laboratory and address: Nuclear Physics Laboratory
Ein Shams University
Faculty of Girls, Heliopolis
Cairo - Egypt

Names: S. Abdel Malak, A. Sroor, S.M. El Meniawy, A. El Shershaby, N. Abdel Basset, N. Walley-Eldin, M. Abdel Wahab, A. Nada, Z.Y. Morsy, E. Abdel Hameed and F. Abdallah

Facilities: Caoxial Hyper pure Ge GEM-10190
Pop top Hyper pure Ge gamma X detector
GMX-15185-P
Planner Hyper pure Ge
ORTEC M.C.A. card mounted on an IBM compatible P.C.
Scintillation detectors
Electronic equipment for gamma singles
γ-γ coincidence, angular correlations and life time set ups.

Experiments: Studies of level schemes following the decay of different radioactive isotopes.

Method: X and gamma ray singles, γ-γ fast slow coincidence spectrometer, γ-γ angular correlation and life time measurements.

Completion date: Published data on: ^{143}Pr, ^{186}Os, ^{75}As, ^{129m}Te & ^{129g}Te, ^{161}Tb, ^{153}Eu, ^{153}Gd, ^{103}Ru, ^{124}Te, ^{175}Yb, ^{153}Sm, ^{159}Tb, ^{187}W, ^{140}Ce, ^{99}Tc, ^{147}Nd, ^{152}Sm and ^{182}Ta.

Analysis in progress: ^{154}Eu, ^{160}Tb, ^{241}Am, ^{152}Eu, ^{169}Yb, ^{115}Cd, ^{192}Ir and ^{188}Re.

Publications:

1. Spins and mixing ratios in ^{143}Pr
Nucl. Sci. J. 28 (5), October 1991.

Publications:

2. Transitions in ^{186}Os following β decay ^{186}Re
J. Faculty of Education, No. 17, 1992.

3. Energy levels of ^{75}As following the EC-decay of ^{75}Se
Nucl. Sci. J. 28 (2), April 1991.

4. Studies in the decay of ^{129m}Te and ^{129g}Te
Nucl. Sci. J. 27 (4), August 1990.

5. Ge(Li)-NaI(T1) coincidence studies of the ^{161}Tb decay
Journal of the Faculty of Education, No. 15, 1990.

6. Intensity, coincidence and life time measurements of ^{143}Ce
Nucl. Sci. J. 27 (1), February 1990.

7. Transitions in ^{153}Eu following the decay of ^{153}Gd
Nucl. Sci. J. 24 (1), February 1987.

8. Intensity and angular correlation measurements of ^{103}Ru
Hadronic Journal (USA) Vol. 10, Number 1, January 1987.

9. Nuclear structure of ^{124}Te
Journal of the Faculty of Education, No. 10, 1986.

10. The β-decay of ^{175}Yb
Ncul. Sci. J. 23 (5), October 1986.

11. Spins and mixing ratios in ^{153}Eu
Nucl. Sci. J. 23 (1), March 1986.

12. Studies on the energy levels of ^{153}Eu following the β-decay of ^{153}Sm
Z. Phy. A Atoms and Nuclei 322, (163-167) 1985.

13. Energy levels of ^{159}Tb following the β-decay of ^{159}Gd
Nucl. Sci. J. 22 (2), June 1985.

14. Studies on the decay of ^{187}W
Acta Physica Hungarica 60 (1-2), pp (95-105) 1986.

EGYPT (cont'd)

Publications:

15. The level structure of ^{140}Ce
Acta Physica Hungarica 60 (1-2), pp(3-17) 1986.

16. On the level structure of ^{99}Tc
Nucl. Sci. J. 20 (2), June 1983.

17. Studies of the radioactive decay of ^{147}Nd
Nucl. Sci. J. 20 (1), March 1983.

18. Dependence of the resolution of Ge (Li) and hyper pure Ge detectors on the counting rate
Atomkernenergie, Kerntechnik Bd. 40, Lfg. 3, p. 209, 1982.

19. The ground state bands in ^{152}Sm and ^{160}Dy
Revue Roumaine de Physique Tome 26 no. 5, pp. 461-469, Bucharest 1981.

20. The decay of ^{182}Ta to ^{182}W
Revue Roumaine de Physique Tome 26 no. 5, pp. 455-460, Bucharest 1981.

FRANCE

Laboratory and address:
CEA - CEN Cadarache / DRN DER SPRC
F - 13108 St Paul lez Durance, FRANCE

Names:
K. Dietze, G. Rimpault

Facilities:
Fast-thermal coupled systems RRR/SEG (Rossendorf) and STEK (Petten)

Experiment:
Integral test of FPND by C/E-ratios

Method:
Recalculation of the SEG- and STEK-configurations using the full European scheme JEF-2/ECCO/ERANOS
Reanalysis of the sample reactivity measurements
Separation of capture and scattering effect
Comparison of different FPND
Recommendations for corrections in JEF

Samples:
Mo-95, -97, -98, -100, Rh-103, Pd-105, Ag-109, Cs-133, Nd-143, -145, Sm-149, Eu-153 in SEG
Natural Mo, Cd
About 30 FP nuclides in STEK

Accuracy:
3 - 15 % in C/E-ratios

Completion:
SEG-4, -5, -7A, -7B: completed
SEG-6 and STEK configurations: 1994

Discrepancies to other reported data:
Discrepancies have been stated for different materials

Publications:
K. Dietze, H. Kumpf: Kernenergie 34 (1991) p.1
K. Dietze: Proc. of a Spec. Meeting on FPND, Tokai-mura, May 1992, NEA/NSC/DOC(92)9, p.404
K. Dietze: Note Technique SPRC/LEPH/93-230, Cadarache, 1993
K. Dietze, G. Rimpault: Note Technique SPRC/LEPH/93-237, Cadarache, 1993
K. Dietze, G. Rimpault: Paper for the JEF-2 Working Group Meeting, Paris, Dec.1, 1993

FRANCE

Laboratory: CEA - CEN Cadarache/DRN DER SPRC
F-13108 St Paul les Durance, France

Names: A. Santamarina, P. Albarède

Facilities: MINERVE:
peripheral driver zone and water moderated central lattice MELODIE (other central lattices are available, including the fast lattice ERMINE)

Experiment: Integral test of FPND by comparison of measured and calculated reactivities

Method: Measurements of small sample reactivities using the reactivity oscillator technique. Fission products are measured along with reference samples, with various boron and ^{235}U contents.
Reactivities are calculated using JEF1 and JEF2.2 data.
Discrepancies between experimental and calculated values will show possible inaccuracies in the FP data.

Samples: ^{95}Mo, ^{99}Tc, Ru, ^{103}Rh, Ag, ^{109}Ag, ^{133}Cs, Nd, ^{143}Nd, ^{145}Nd, Sm, ^{147}Sm, ^{149}Sm, ^{152}Sm, ^{153}Eu, ^{155}Gd.

Accuracy: $\Delta k \approx 0.7 \times 10^{-6}$ (range 10^{-4}) equivalent to 250 μg of boron.

Aimed: 5% of FP capture cross sections.

Completion: Experiments nearly completed for the first lattice configuration.
Analysis under way.

Discrepancies to other reported data:
Not available.

Publications: None.

FRANCE

Laboratory : and address : Centre de Recherches Nucléaires et Université Louis Pasteur
BP 20 CRO, 67037 STRASBOURG Cedex / France

Names : A.Abzouzi, M.S.Antony, A.Hachem
V.B.Ndocko Ndongué, and D.Oster

Facilities : Strasbourg University Research Reactor
Fast transfer system
Neutron flux 1.1 $\times 10^{12}$ n/cm^2/s
85 cc coaxial HPGe detector

Experiment : Precision measurements of half-lives of 28 nuclides produced by (n_{th}, γ) reactions

Method : Gamma-rays following the decay of each isotope

Results :

Nucleus	Half-life	Nucleus	Half-life
^{41}Ar	109.640(38)m	^{109m}Pd	4.715(2)m
^{56}Mn	2.5789(1)h	^{109}Pd	13.7012(24)h
^{60m}Co	10.467(6)m	^{123m}Sn	40.06(1)m
^{66}Cu	5.11(1)m	^{122m}Sb	4.191(3)m
^{77}Ge	11.248(2)h	^{122}Sb	2.7238(2)d
^{79m}Se	3.92(1)m	^{149}Nd	1.728(1)h
^{81m}Se	57.28(2)m	^{152m}Eu	9.3116(13)h
^{80m}Br	4.4205(8)h	^{176m}Lu	3.6832(7)h
^{87m}Sr	2.827(1)h	^{177}Lu	6.7479(7)d
^{90m}Y	3.224(5)h	^{193}Os	30.11(1)h
^{94m}Nb	6.263(4)m	^{197}Pt	19.8915(19)h
^{101}Mo	14.61(3)m	^{199}Pt	30.79(5)m
^{101}Tc	14.224(8)m	^{198}Au	2.6966(7)d
^{104m}Rh	4.37(1)m	^{239}Np	2.3565(4)d

Publications :

1. J.Radional. Nucl. Chem., Letters 144/5/359-365/1990/
2. J.Radional. Nucl. Chem., Letters 145/5/361-368/1990/
3. J.Radional. Nucl. Chem., Letters 164/5/303-308/1992/
4. J.Radional. Nucl. Chem., Letters 166/1/63-67/1992/
5. Chart of the Nuclides - Strasbourg 1992, edited by M.S.Antony (June 1993)

Germany

Laboratory:	Forschungszentrum Jülich, Institut für Kernphysik, Postfach 1913, 52425 Jülich Dept. of Math. Phys., Lund Institute of Technology, P.O.Box 118, 22100 Lund, Sweden
Names:	M. Liang, H. Ohm, I. Ragnarsson, K. Sistemich
Facilities:	Fission product separator JOSEF (Reactor DIDO, Jülich)
Experiment:	Determination of the deformation of the odd-neutron nucleus ^{103}Mo ($ß_q = 0.34(1)$). Comparison with results of Particle-Rotor calculations.
Method:	Separation of fission products according to their masses and nuclear charges. Measurements of delayed $ß^-$-γ coincidences following the decay of ^{103}Nb.
Accuracy:	---
Completion:	completed
Publication:	Z. Phys. A346 (1993) 201

Germany

Laboratory:	Forschungszentrum Jülich, Institut für Kernphysik, Postfach 1913, 52425 Jülich
Names:	M.-L. Stolzenwald, G. Lhersonneau, M. Liang, G. Molnár, H. Ohm, K. Sistemich
Facilities:	Fission product separator JOSEF (Reactor DIDO, Jülich)
Experiment:	Decay scheme of the 2.0 s β^- decaying isomer of ^{98}Y. Nature of this isomeric state and of levels in ^{98}Zr.
Method:	Separation of fission products according to their masses and nuclear charges. Measurement of the γ radiation from the β^- decay of ^{98}Y. γ-γ angular-correlation studies.
Accuracy:	---
Completion:	completed
Publication:	submitted to Z. Phys.

Germany

Laboratory:	Forschungszentrum Jülich, Institut für Kernphysik, Postfach 1913, 52425 Jülich
Names:	M. Liang, H. Ohm, U. Paffrath, B. De Sutter, K. Sistemich
Facilities:	Fission product separator JOSEF (Reactor DIDO, Jülich)
Experiment:	Study of the odd-proton deformed nucleus ^{103}Nb. Determination of an extended level scheme and of the deformation ($ß_q = 0.31(3)$) via level lifetimes. Comparison with the results of Nilsson-model calculations.
Method:	Separation of fission products according to their masses and nuclear charges. Measurements of the γ radiation from the $ß^-$ decay of the ^{103}Zr parent and of ß-γ delayed coincidences.
Accuracy:	---
Completion:	completed
Publication:	Z. Phys. A344 (1993) 357 Inst. Phys. Conf. Ser. No 132, p. 643

GERMANY

Laboratory and address:	Kernforschungszentrum Karlsruhe, Institut für Kernphysik Postfach 3640, D-76021 Karlsruhe, Germany
Facilities:	Pulsed 3.7 MV Van de Graaff
1. Names:	C.M. Raiteri, R. Gallino, M. Busso, D. Neuberger, F. Käppeler
Experiment:	Measurement of the Maxwellian average (n,γ) cross section of ^{87}Rb at kT=25 keV
Method:	Activation technique
Accuracy:	±2.7%
Completion date:	completed
Publications:	The Astrophysical Journal 419 (1993) 207-223
2. Names:	K.A. Toukan, K. Debus, F. Käppeler, G. Reffo
Experiment:	Measurement of the Maxwellian average (n,γ) cross sections of ^{146}Nd, ^{148}Nd, and ^{150}Nd at kT=25 keV
Method:	Activation technique
Accuracy:	±5 to 6%
Completion date:	completed
Publications:	in preparation
3. Names:	K. Wisshak, K. Guber, F. Voss, F. Käppeler, G. Reffo
Experiment:	Measurement of the differential (n,γ) cross sections of ^{147}Sm, ^{148}Sm, ^{149}Sm, ^{150}Sm, and ^{152}Sm between 3 and 220 keV neutron energy
Method:	Time-of-flight technique in combination with 4π BaF_2 detector
Accuracy:	±1 for cross section ratios, ±2% absolute
Completion date:	completed
Publications:	Phys. Rev. C 48 (1993) 1401-1419
4. Names:	S. Jaag, F. Käppeler
Experiment:	Measurement of the Maxwellian average (n,γ) cross sections of ^{155}Eu, ^{163}Ho, and ^{162}Er at kT=25 keV
Method:	Activation technique
Accuracy:	±4.5, 6.4, and 7.6%, respectively
Completion date:	completed
Publications:	in preparation

GERMANY

Laboratory and address:	Physikalisch-Technische Bundesanstalt Bundesallee 100, D-38116 Braunschweig
Names:	E. Schönfeld, U. Schötzig, H. Schrader
Facilities:	Ionization chamber; Ge spectrometer
Experiment:	1. Determination of half-lives of ^{85}Kr and ^{90}Sr 2. Determination of - X-ray and gamma-ray emission probabilities of ^{125}Sb and ^{141}Ce; - beta-transition probabilities of ^{141}Ce; - total conversion coefficient of the 145-keV transition in ^{141}Ce.
Method:	1. The decay of the radioactive substance in a source is followed by ionization chamber measurements. 2. Use of a 4π-beta-gamma coincidence system for activity measurements and calibrated germanium spectrometers for photon emission rate measurements.
Accuracy:	0.1 to 2 %
Completion date:	completed
Publications	E. Schönfeld, H. Janßen and U. Schötzig: Decay Data of ^{141}Ce. Appl. Radiat. Isot. 43(1992), p. 1071-1077. U. Schötzig, H. Schrader and K. Debertin: Precision Measurements of Radioactive Decay Data. Proceedings of an International Conference on "Nuclear Data for Science and Technology", Jülich, Germany, 13-17 May 1991. Springer Verlag, Berlin 1992, p. 562-564.

GERMANY

Laboratory and Address:	Institut für Metallphysik und Nukleare Festkörperphysik Technische Universität Braunschweig Mendelssohnstr. 3 D-38106 Braunschweig
Name:	F. Münnich
Facilities:	On-line mass separator LOHENGRIN, installed at the high-flux reactor of the ILL, Grenoble, France and CERN-ISOLDE, Geneva, Switzerland
Experiments:	1) Determination of β-decay energies of very neutron rich isotopes available from fission and spallations of ^{235}U and ^{239}Pu
Method:	βγ-Coincidence measurements with a plastic-scintillator telescope.
Accuracy:	ΔE between 10 keV and 100 keV, depending upon the complexity of the decay scheme.
Completion date:	Systematic investigation
Publications:	Experimental β-Decay Energies of $^{91,92}Br$; Nucl. Phys. A491. 373 (1988) *) Experimental β-Decay Energies of Very Neutron-Rich Fission Products with 107 ≤ A ≤ 109; Z. Physik A334, 239 (1989) +) Beta-Decay Energies and Nuclear Masses of ^{148}Ba, ^{148}La and ^{151}Pr; Z. Physik A336, 247 (1990) Experimental β-Decay Energies of Very Neutron-Rich Isobars with Mass Numbers A = 101 and A = 102; Z. Physik A342, 125 (1992) **) Experimental $Q_β$-Values of Very Neutron-Rich Light Fission Products in the Mass Range 85 ≤ A ≤ 108; Proc. 6th Int. Conf. on Nuclei Far From Stability, Bernkastel-Kues 1992, Int.Phys.Conf.Ser.No.132,p.77(1993)

*) $^{91,92}Br$, $^{91,92}Kr$

+) ^{107}Mo, $^{107-109}Tc$, $^{107-109}Ru$, ^{108}Rh

**) ^{101}Rb, $^{101,102}Sr$, $^{101,102}Y$

GERMANY

Laboratory: Institut für Kernchemie
Universität Mainz
Postfach 3980, D-55099 Mainz, Germany
Tel.: 06131-395879, Fax: 06131-395253
E-Mail: DENSCHLAG at VKCMZD.Chemie.Uni-Mainz.De

1.

Names:	R. Hentzschel, H. O. Denschlag
Facilities:	TRIGA Reactor, this institute
Experiment:	Isomeric yield ratios of ^{134}I and ^{136}I and independent fractional yields of some halogen isotopes in the fission of ^{232}Th with reactor neutrons
Method:	Rapid chemical separation of the fission iodine and -bromine from precursors and from other fission products
Accuracy:	5 %
Completion:	Completed
Publication:	R. Hentzschel, H. O. Denschlag, Radiochimica Acta 50, 1 (1990)

2.

Names: P. Stumpf, U. Güttler, H. O. Denschlag (Univ. Mainz), and H. Faust (ILL, Grenoble)

Facilities: LOHENGRIN mass separator for unslowed fission products at the Institut Laue-Langevin, Grenoble

Experiment: Determination of mass yields and charge distribution of very light fission products in the reaction $^{241}Am(2n,f)$ at various kinetic energies of the fission fragments.

Method: Mass separated fission products are stopped in a large ionization chamber that provides a signal of the total fragment energy and of the specific energy loss.

Accuracy: A few percent

Completion: Experimentally completed

Publication: P. Stumpf, Dissertation, Mainz, in preparation; P. Stumpf, U. Güttler, H. O. Denschlag, H. R. Faust: Odd-Even Effects in the Reaction $^{241}Am(2n,f)$, in (S.M. Qaim, Ed.) Nuclear Data for Science and Technology, Springer Verlag, Berlin (1992), p. 145, and Progress Report on Nuclear Data Research in the Federal Republic of Germany, NEANDC(E)-322-U Vol.V, INDC(Ger)-36/LN+Special; KfK 4953, p. 64

3.

Names: U. Güttler, P. Stumpf, H. O. Denschlag (Univ. Mainz), and H. Faust (ILL, Grenoble)

Facilities: LOHENGRIN mass separator for unslowed fission products at the Institut Laue-Langevin, Grenoble

Experiment: Determination of mass yields in the symmetric region of the reaction $^{241}Am(2n,f)$ at various kinetic energies of the fission fragments.

Method: Mass separated fission products are stopped in a large ionization chamber that provides a signal of the total fragment energy.

Accuracy: A few percent

Completion: First series of experiments completed; problems with scattered fragments require further work.

Publication: U. Güttler, Dissertation, Mainz (1991);

4.

Names: W. Ditz, H. O. Denschlag (Univ. Mainz), and H. Faust (ILL, Grenoble)

Facilities: LOHENGRIN mass separator for unslowed fission products at the Institut Laue-Langevin, Grenoble

Experiment: Determination of mass yields and charge distribution of very light fission products (mass numbers A = 68 to 86) in the reaction $^{239}Pu(n_{th},f)$ at various kinetic energies of the fission fragments.

Method: See above (Experiment No. 2)

Accuracy: A few percent

Completion: Experimentally completed

Publication: W. Ditz, Dissertation, Mainz (1991)

5.

Names: Hans O. Denschlag, O. Alhassanieh, M. Weis, W. Faubel (Univ. Mainz), and H. R. Faust (ILL, Grenoble)

Facilities: LOHENGRIN mass separator for unslowed fission products at the Institut Laue-Langevin, Grenoble

Experiment: Determination of absolute gamma-ray line intensities in the decay of 2.6 min ^{99}Nb and the branching ratio in the decay of ^{99}Zr to the two isomers ^{99m}Nb and ^{99g}Nb.

Method: The decay characteristics have been determined by comparing gamma-ray spectra of a mass separated fraction of chain 99 with the known yield distribution.

Accuracy: A few percent

Completion: Experimentally completed

Publication: Hans O. Denschlag, O. Alhassanieh, M. Weis, W. Faubel, and H. R. Faust; Radiochimica Acta, in press.

6.

Names: R. Hentzschel, Hans O. Denschlag (Univ. Mainz), H. R. Faust (ILL, Grenoble), J. Gindler, B. D. Wilkins (Argonne, Natl. Lab., USA)

Facilities: LOHENGRIN mass separator for unslowed fission products at the Institut Laue-Langevin, Grenoble

Experiment: Determination of mass yields and charge distribution of very light fission products in the reaction $^{249}Cf(n,f)$ at various kinetic energies of the fission fragments.

Method: see Experiment No. 2 above

Accuracy: A few percent

Completion: Experimentally completed

Publication: R. Hentzschel, H. R. Faust, H. O. Denschlag, B. D. Wilkins, J. Gindler: Mass, Charge and Energy Distributions in the Very Asymmetric Fission of ^{249}Cf Induced by Thermal Neutrons, Nuclear Physics A, in press

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7.

Names: R. Hentzschel, Hans O. Denschlag (Univ. Mainz), H. R. Faust (ILL, Grenoble)

Facilities: LOHENGRIN mass separator for unslowed fission products at the Institut Laue-Langevin, Grenoble

Experiment: Determination of the yield of ^{14}C at various kinetic energies and ionic charge states in the reaction $^{249}Cf(n,f)$

Method: Mass separated ions with A = 14 are stopped in a large ionization chamber that provides a signal of the total fragment energy and of the specific energy loss. The latter allows a Z-identification of the carbon-ions.

Accuracy: A few percent

Completion: Experimentally completed

Publication: R. Hentzschel, Dissertation, Mainz (1991)

8.

Names: R. Hentzschel, Hans O. Denschlag (Univ. Mainz), H. R. Faust (ILL, Grenoble)

Facilities: LOHENGRIN mass separator for unslowed fission products at the Institut Laue-Langevin, Grenoble

Experiment: Determination of mass yields in the symmetric region of the reaction $^{249}Cf(n,f)$ at various kinetic energies and ionic charge states of the fragments.

Method: Mass separated fission products are stopped in a large ionization chamber that provides a signal of the total fragment energy.

Accuracy: A few percent

Completion: Experimentally completed

Publication: R. Hentzschel, Dissertation, Mainz (1991)

9.

Names: O. Alhassanieh, H. O. Denschlag, V. Scheuermann (Univ. Mainz), H. R. Faust (ILL, Grenoble)

Facilities: LOHENGRIN mass separator for unslowed fission products at the Institut Laue-Langevin, Grenoble

Experiment: The fission yield ratios of isomeric states of several fragment masses in the reaction $^{249}Cf(n,f)$ have been measured at various kinetic energies and ionic charge states of the fragments.

Method: Mass separated fission fragments were intercepted on a moving transport tape, carried continuously in front of a Ge(Li) gamma-ray detector, and relative fission yields were measured using the gamma-rays emitted following the ß-decay of these fragments.

Accuracy: A few percent

Completion: Experimentally completed

Publication: O. Alhassanieh, Dissertation, Mainz, in preparation; O. Alhassanieh, H.O. Denschlag, V. Scheuermann, H. R. Faust: Isomeric Yield Ratios and Distribution of Angular Momentum in the Fission of ^{249}Cf by Thermal Neutrons; Progress Report on the Nuclear Data Research in the Federal Republic of Germany, Report NEA/NSC/DOC(93)17 INDC(Ger)-037/LN Jül-2803 (1993)

INDIA

LABORATORY AND ADDRESS	Radiochemistry Division Bhabha Atomic research Centre Trombay, BOMBAY 400085, INDIA
NAMES	R.H.Iyer, H.Naik, P.C.Kalsi, A.K.Pande A.Ramaswami, R.J.Singh and A.G.C.Nair
FACILITIES	Class A Laboratory, High Resolution gamma ray spectrometric system with HPGe Detectors.
EXPERIMENT	Absolute Yields of fission products in the neutron induced fission of ^{238}U
METHOD	Absolute yields of twenty five fission products including the yields of short lived and low yield symmetric fisson products have been determined using the track-etch cum gamma ray spectrometric technique. Highly depleted ^{238}U (isotopic purity 99.997 atom% with $^{235}U < 1.5\ 10^{-4}$ atom %) has been used for this work.
ACCURACY	± 10% On yields
STATUS	Work continuing.
PUBLICATIONS	Progress report on the IAEA research contract 6495/R1/RB Oct 92 - Jun 93

INDIA

LABORATORY AND ADDRESS	Radiochemistry Division Bhabha Atomic research Centre Trombay, BOMBAY 400085, INDIA
NAMES	R.H.Iyer, H.Naik, P.C.Kalsi, A.K.Pande A.Ramaswami, R.J.Singh and A.G.C.Nair
FACILITIES	Class A Laboratory, High Resolution gamma ray spectrometric system with HPGe Detectors.
EXPERIMENT	Absolute Yields of fission products in the neutron induced fission of ^{237}Np
METHOD	Absolute yields of thirty fission products including the yields of short lived and low yield symmetric fisson products have been determined using the track-etch cum gamma ray spectrometric technique. The number of fissions occuring in the target is determined by recording the fission events in a solid state track detector and the fission products are determined by direct gamma ray spectrometry.
ACCURACY	$\pm$ 10% On yields
STATUS	Work continuing
PUBLICATIONS	Progress reports No.1 &2 on the IAEA research contract No.6495/RB May 91 - Feb 92 and Oct 92 - Jun 93

INDIA

LABORATORY AND ADDRESS	Radiochemistry Division Bhabha Atomic research Centre Trombay, BOMBAY 400085, INDIA
NAMES	R.H.Iyer, H.Naik, P.C.Kalsi, A.K.Pande A.Ramaswami, R.J.Singh and A.G.C.Nair
FACILITIES	Class A Laboratory, High Resolution gamma ray spectrometric system with HPGe Detectors.
EXPERIMENT	Absolute Yields of fission products in the neutron induced fission of ^{243}Am
METHOD	Absolute yields of thirteen short lived fission products have been determined using the track-etch cum gamma - ray spectrometric technique. This forms the first set of experimentally measured yield data for this system.
ACCURACY	± 10% On yields
STATUS	Work continuing
PUBLICATIONS	Progress report on the IAEA research contract No.6495/R1/RB Oct 92-Jun 93

INDIA

LABORATORY AND ADDRESS:	Radiochemistry Division Bhabha Atomic Research Centre Trombay, Bombay 400 085, India
NAMES:	H. Naik, S.P. Dange, R.J. Singh & T. Datta
Facilities:	Reactor neutron irradiation, Class-A Radiochemical Laboratory, High Resolution Gamma (HPGe) Spectrometer.
Experiment:	Fission fragment angular momentum for $^{130,132}Sb$, $^{131,133}Te$, ^{134}I, ^{135}Xe & ^{138}Cs in $^{229}Th(n,f)$ system.
Method:	Radiochemical and Gamma-Spectrometric Independent Isomeric Yield Ratios for seven fission products - Spin dependent Statistical model analysis.
Accuracy:	≤10%
Status:	Fragment spin is higher for odd-Z cases Inverse correlation is seen between the fragment spins and elemental yields.
Publication:	Proc. DAE Symp. on Nucl. Phys. v-36B, p-190(1993).

JAPAN

Laboratory and Address:	Nuclear Data center Japan Atomic Energy Research Institute Tokai-mura, Naka-gun, Ibaraki-ken 319-11, Japan
Name:	Y. Nakajima, M. Ohkubo, M. Mizumoto, M. Sugimoto
Facilities:	JAERI 120 MeV electron linear accelerator
Experiment:	Neutron resonance parameters
(1) Sample:	^{121}Sb, ^{123}Sb, ^{140}Ce and ^{142}Ce
Method:	Neutron time-of-flight, neutron transmission
Detector:	^{6}Li-glass scintillation detector
Flight path:	47 m
Resonance analysis:	Modified single level Atta-Harvey area analysis code and multi-level shape fit code SIOB
Energy region:	Less than 0.6 keV for ^{121}Sb. less than 1.3 keV for ^{123}Sb, less than 5.3 keV for ^{140}Ce and ^{142}Ce.
Publication:	M. Ohkubo et al., "Neutron transmission measurements on ^{121}Sb, ^{123}Sb, ^{140}Ce and ^{142}Ce", JAERI-M 93-012(1993).
(2) Sample:	^{133}Cs
Method:	Neutron time-of-flight, neutron transmission and capture
Detector:	^{6}Li-glass scintillation detectors for neutron transmission and flux measurements and 3,500 l liquid scintillation detector
Flight path:	52 m for capture measurements and 47 m and 190 m for transmission measurements
Analysis:	Area analysis code TACASI for capture data and shape analysis code SIOB for transmission data
Energy region:	Less than 2.0 keV for capture data, less than 5.0 keV for transmission data
Publication:	Y. Nakajima et al., "Neutron resonances in ^{133}Cs", Annals of Nuclear Energy 17 (1990) 569.

JAPAN

Laboratory and address:	Research Reactor Institute, Kyoto University Kumatori-cho, Sennan-gun, Osaka 590-04, Japan
Names:	I. Tago, Y. Kawase and K. Okano
Facilities:	On-line isotope separator(KUR-ISOL) installed at 5 MW Kyoto University Reactor.
Experiment:	Gamma-rays in the Decay of ^{152}Pr
Method:	Gamma-rays and X-rays from mass separated ^{152}Pr were measured with a HPGe and LEPS spectrometers. The new 14 γ-rays have been found and energies and intensities of them have been determined.
Accuracy:	Estimated errors are about 5% for intensities and less than 1 keV for energies.
Completion date:	The measurements of singles spectra and the β-decay half-life are completed. Decay scheme studies are planned.
Publications:	Annu. Rep. Res. Reactor Inst., Kyoto Univ., 23 (1990)179

JAPAN

Laboratory and address:	Research Reactor Institute, Kyoto University Kumatori-cho, Sennan-gun, Osaka 590-04, Japan
Names:	I. Tago, Y. Kawase and K. Okano
Facilities:	On-line isotope separator(KUR-ISOL) installed at 5 MW Kyoto University Reactor.
Experiment:	Identification of ^{152}Ce
Method:	Gamma-rays and X-rays from mass separated isotopes were measured with a HPGe and LEPS spectrometers. ^{152}Ce has been identified by the mass number and energies of γ-rays and X-rays of the relevant activity.
Accuracy:	Estimated errors are less than 0.1 keV for energies and shorter than 0.3 s for the half-life.
Completion date:	The measurements of singles spectra and the β-decay half-life are completed. Decay scheme studies are planned.
Publications:	Z. Phys. A-Atomic Nuclei, 335(1990)477

JAPAN

Laboratory and address:	Research Reactor Institute, Kyoto University Kumatori-cho, Sennan-gun, Osaka 590-04, Japan
Names:	T. Sharshar, K. Okano, Y. Kawase and S. Yamada
Facilities:	On-line isotope separator(KUR-ISOL) installed at 5 MW Kyoto University Reactor.
Experiment:	Gamma-rays and Half-Life of ^{157}Pm
Method:	Gamma-rays and X-rays from mass separated ^{157}Pm were measured with a HPGe and LEPS spectrometers. The new 30 γ-rays have been found and energies and intensities of them have been determined.
Accuracy:	Estimated errors are about 5-10% for intensities and 0.1-0.3 keV for energies.
Completion date:	The measurements of singles spectra and the β-decay half-life are completed. Decay scheme studies are planned.
Publications:	Annu. Rep. Res. Reactor Inst., Kyoto Univ., 25 (1992)91

JAPAN

Laboratory: 1) Department of Nuclear Engineering, Nagoya University
2) Radioisotope Research Center, Nagoya University
3) Power Reactor and Nuclear Fuel Development Corp.

Address: 1,2) Furo-cho, Chikusa-ku, Nagoya, 464-01, JAPAN
3) Tokai-mura, Ibaraki-ken, 319-11, JAPAN

Names: T. Katoh[1)], Y. Ogata[2)], H. Harada[3)], S. Nakamura[3)]

Facility: Nuclear Reactor at Rikkyo University

Experiment: Measurement of Neutron Capture Cross Section of ^{99}Tc

Method: The thermal neutron cross section of the $^{99}Tc(n,\gamma)^{100}Tc$ reaction has been measured by means of an activation method. Targets containing about 370 kBq of ^{99}Tc were irradiated for 2 m with reactor neutrons. Activation detectors of Co/Al and Au/Al alloy wires were irradiated to monitor the neutron flux. Spectra of γ-rays from the irradiated Tc samples were measured with a high purity Ge detector. A cross section of the $^{99}Tc(n,\gamma)^{100}Tc$ reaction was determined from the number of ^{99}Tc atoms of the target, the activity of the produced ^{100}Tc and the neutron flux data. The cross section obtained is 18 $\pm$ 2 b.

Accuracy: Error of the cross section is less than 2 b.

Completion date: More precise experiments are in progress.

Publication: Results will be presented at the International Conference on Nuclear Data which will be held in May 1994 at Gatlinburg, USA.

JAPAN

Laboratory: 1) Department of Nuclear Engineering, Nagoya University
2) Japan Atomic Energy Research Institute
3) Power Reactor and Nuclear Fuel Develop. Corp.

Address: 1) Furo-cho, Chikusa-ku, Nagoya, 464-01, JAPAN
2, 3) Tokai-mura, Ibaraki-ken, 319-11, JAPAN

Names: T. Sekine[2], Y. Hatsukawa[2], K. Kobayashi[2], H. Harada[3], H. Watanabe[3], T. Katoh[1]

Facility: Nuclear Reactor at Japan Atomic Energy Research Institute

Experiment: Measurement of Thermal Neutron Cross Section and Resonance Integral of the Reaction $^{137}Cs(n, \gamma)^{138}Cs$

Method: The thermal neutron cross section and the resonance integral of the reaction $^{137}Cs(n, \gamma)^{138}Cs$ have been measured by means of a modified Cd-ratio technique. After neutron irradiation, the irradiated ^{137}Cs samples were purified chemically and their gamma-ray spectra were measured with a high purity Ge detector. The resulting yields of ^{138}Cs for different neutron spectra and the neutron flux data have yielded that the thermal neutron cross section (for 2, 200 m/s neutrons) is 0. 25 ± 0. 02 b and the resonance integral 0. 36 ± 0. 07 b.

Accuracy: A probable uncertainty was estimated to be 1. 2% or 3. 9%, depending on the spin of the compound nucleus produced in the s-wave neutron capture.

Completion date: November 1992

Publication: J. Nuclear Science and Technology, vol. 30(1993) pp. 1099-1106

JAPAN

Laboratory: Department of Energy Engineering and Science, Nagoya University

Address: Furo-cho, Chikusa-ku, Nagoya, 464-01, JAPAN

Names: M. Shibata, T. Ikuta, A. Taniguchi, A. Osa, M. Asai, A. Tanaka, J. Ruan, K. Aoki, T. Tamai, Y. Kawase, K. Okano, H. Yamamoto, K. Kawade

Facility: 5 MW Research Reactor of Kyoto University,
He-jet type Isotope Separator On-line (KUR-ISOL)
100 kW TRIGA-II reactor of Rikkyo University

Experiments: Decays of ^{152}Nd, ^{151}Pr and ^{147}Pr

Method: Measurements of γ-singles, internal conversion electrons, γ-γ coincidence, β-γ coincidence, β-γ delayed coincidence. The radioactive sources were separated from the fission products of ^{235}U(n,f) with an on-line isotope separator (KUR-ISOL). Precise decay schemes of ^{152}Nd to ^{152}Ce, ^{151}Pr to ^{151}Nd and ^{147}Pr to ^{147}Nd were constructed.

Accuracy: 5% to 30% for γ-ray intensities, 20% to 50% for internal conversion coefficients, 0.06 ns to 0.3 ns for half-lives of excited states.

Completion: Finished (see publications).

Publication:

M. Shibata, M. Asai, T. Ikuta, H. Yamamoto, J. Ruan, K. Okano, K. Aoki and K. Kawade: Appl. Radiat. Isot. 44(1993), pp. 923-926 "Decay scheme of mass-separated ^{152}Nd"

M. Shibata, A. Taniguchi, H. Yamamoto, K. Kawade, J. Ruan, Y. Kawase and K. Okano: J. Phys. Soc. Jpn, 62(1993), pp. 87-96, "Low-lying levels in ^{147}Nd in the decay of^{147}Pr"

M. Shibata, T. Ikuta, A. Taniguchi, A. Osa, A. Tanaka, H. Yamamoto, K. Kawade, J. Ruan, Y. Kawase and K. Okano: submitted to J. Phys. Soc. Jpn, "Beta decay of ^{151}Pr into levels in ^{151}Nd"

JAPAN

Laboratory : Department of Nuclear Engineering, Nagoya University

Address : Furo-cho, Chikusa-ku, Nagoya 464-01, Japan

Names : Hiroshi Miyahara and Chizuo Mori

Facilities : $4\pi\beta$(ppc)-γ(HPGe) coincidence apparatus using a live-timed bi-dimensional data acquisition system

Experiment : Measurement of gamma-ray emission probability

Method : The disintegration rates for sample sources and standard sources were determined by using the above $4\pi\beta$(ppc)-γ(HPGe) coincidence system and the γ-ray intensities were determined from the γ-ray spectra obtained by the HPGe detector.

Accuracy : (1) The emission probability for the 1077 keV γ-rays of ^{86}Rb was measured to be 0.08884±0.00029.

(2) The emission probabilities for the 497, 557 and 610 keV γ-rays of ^{103}Ru were measured to be 0.9147±0.0029, 0.00853±0.0006 and 0.05805±0.00024, respectively.

(3) The emission probability for the 1039 keV γ-rays of ^{66}Cu was measured to be 0.0911±0.0009.

(4) The emission probability for the 443 keV γ-rays of ^{128}I was measured to be 0.1267±0.0009.

Completion date : (1) Nov. 1989, (2) Nov. 1989, (3) Jan. 1991, (4) Oct. 1992

Publications : (1) Appl. Radiat. Isot. 42, 485 (1991)

(2) Nucl. Instr. and Meth. A312, 359 (1992)

(3) Nucl. Instr. and Meth. A324, 219 (1993)

(4) Nucl. Instr. and Meth. A336, 385 (1993)

RUSSIA

LABORATORY AND ADDRESS	Institute of Physics and Power Engineering Bondarenko sq. 1, Obninsk, Kaluga Region, Russia, 249020
NAMES	Goverdovsky A.A., Mitrofanov V.F.
FACILITY	2.5-MeV accelerator (high - current 100 mkAmp cascade generator), IPPE, Obninsk
EXPERIMENT	Mass-energy distributions have been measured for Np-237 fission fragments in the neutron energy range from 0.28 to 1.28 MeV (10 energy points). The data are analyzed in a model of open fission channels (Brosa-model). Structural features are resolved in the behaviour of the mean total kinetic energy of the fragments in sub-barrier fission. A systematics is offered for the variances of the mass-asymmetric component of the spectrum for heavy nuclei. Direct observation of Brosa-channels was declared as a strong confirmation of valleys-model.
METHOD	2E-method, semiconductor detectors, U-235 thermal fission calibration. Neutron source: T(p,n)-reaction in a 1 mg/cm2 tritium-scandium target on a water-cooled copper backing. The fissile target was a thin (93(5) mkg/cm2) layer of neptunium fluoride, vacuum-deposited on an aluminum oxide substrate, 40(1) mkg/cm2 thick. The isotopic purity of the original target material was 99.9 % Np.
ACCURACY	For fission fragments: TKE: 100 - 200 keV, mass: 2 - 3 amu. Mass - curve statistics from 10 to 10 events.
COMPLETION DATE	completed
PUBLICATIONS	Goverdovsky, A.A., et.al., Yad.Fiz. 55 (1992) 16, (English: Sov.J.Nucl.Phys. 55 (1992) 9)

RUSSIA

LABORATORY AND ADDRESS	Institute of Physics and Power Engineering Bondarenko sq. 1, Obninsk, Kaluga Region, Russia, 249020
NAMES	Goverdovsky A.A., Mitrofanov V.F.
FACILITY	2.5-MeV accelerator (high - current 100 mkAmp cascade generator), IPPE, Obninsk
EXPERIMENT	Symmetric and asymmetric fission of U-236,238, Np-237 and Am-243 by 16.5 MeV neutrons in comparison with 1 MeV neutrons were measured and analyzed. The data are analyzed in a model of open fission channels (Brosa-model).
METHOD	2E-method, semiconductor detectors, U-235 thermal fission calibration. Neutron source - T(p,n)-reaction in a 1 mg/cm2 tritium-scandium target, on a water-cooled copper backing. The fissile targets were thin (100(8) mkg/cm2) layers of actinide fluorides, vacuum-deposited on an aluminum oxide substrate, 40(1) mkg/cm2 thick. The isotopic purities of the original target materials were 99.9 %.
ACCURACY	For fission fragments: TKE: 100 - 200 keV, mass: 2 - 3 amu. Mass - curve statistics from 5x10 to 10 events.
COMPLETION DATE	completed
PUBLICATIONS	1.Goverdovsky, A.A. et.al., Yad.Fiz. 56 (1993) 43, (English: Phys.At.Nucl. 56(1993)24). 2.Goverdovsky,A.A. et.al., INDC(CCP)-341, 1991 Vienna. IAEA

RUSSIA

LABORATORY AND ADDRESS	Institute of Physics and Power Engineering Bondarenko sq. 1, Obninsk, Kaluga Region, Russia, 249020
NAMES	Goverdovsky A.A., Mitrofanov V.F., Khrjachkov V.A., Kuz'minov B.D., Semenova N.N.
FACILITY	2.5-MeV accelerator (high-current 100 mkAmp cascade generator), IPPE, Obninsk
EXPERIMENT	Mass-energy distributions have been measured for 1 MeV neutron induced fission of U-236 and thermal and 1 MeV neutron induced fission of U-235 in the mass region 58-170 amu. For U-236, mass - energy and emission angle correlations were analyzed. Search for fission components near the double magic Sn and the high mass-asymmetric tail was done using all available information. Spectra of cold fragmentation process were connected with the initial stage of the descent from the top of the fission barrier to the scission point. It can be used for the prediction of amount and properties of fission components. For the highly asymmetric part of the fission fragment mass curve, a high level of exotic nuclei like Fe-54-64 and Ni-65-74 was observed. Evaluation of fission yield data for M = 60-170 amu is in progress. The analysis of the prescission neutron emission probability showed that the energy dissipation process plays an important role in the fission fragment mass curve formation.
METHOD	2E-method,twin gridded ionization chamber. Fast data aquisition system. Neutron source: T(p,n)-reaction in a 1 mg/cm2 tritium - scandium target on a water-cooled copper backing. The fissile target was a thin (50(5) mkg/cm2) layer of uranium fluoride, vacuum-deposited on a 40(1) mkg/cm2 thick aluminum oxide substrate. The isotopic purity of the original target material was 99.992 % U.
ACCURACY	For fission fragments: TKE: 100-200 keV, M: 2-3 amu. Mass-curve statistics from 10 to 2x10 events.
COMPLETION DATE	completed
PUBLICATIONS	1.Goverdovsky,A.A., et.al. Yad.Fiz. 55 (1992) 2333 2.Khrjachkov,V.A., et.al. Yad.Fiz. 53 (1991) 621 3.Goverdovsky,A.A. et.al. Yad.Fiz. 56(12) (1993) 40 4.Goverdovsky,A.A. et.al. Yad.Fiz. 56(6) (1994) to be published. 5.Goverdovsky,A.A., et.al., INDC(CCP)-341 (1991) 6.Goverdovsky,A.A., et.al., Proc.Int. Conf Juelich 1991, Vol.1, p.139. 7.Goverdovsky,A.A., et.al., Proc.Int. Conf 1993. Smolenice, to be published. 8.Goverdovsky,A.A., et.al., Proc.Int. Conf 1993. Obninsk, to be published.

RUSSIA

Laboratory and adress:	General and Nuclear Physics Insitute, Russian Research Centre "Kurchatov Institute". 123182 Moscow ,Kurchatov Square,1,Russia
Names:	Pelekhov V.I.,Sergeev M.V.,Letarov V.A.
Facilities:	Conversion electron spectrometer with Si(Li) detector and superconducting solenoid, installed at the neutron beam of IR-8 research reactor of this institute.
Experiment:	A study of prompt conversion transition in post-neutron-emission pre-beta decay mass-identified fragments from fission of some actinidies by thermal neutrons.
Method:	Prompt conversion electrons spectroscopy with a semiconductor detectors from mass and total kinetic energy identified fragments.The spectra in the energy range of 15 - 250 keV electrons emitted by one of the complementary fragments within 0.6-1.4 ns from the fission moment are measured.
Accuracy:	for strong conversion transitions electron energies to 1 keV, the fragment mass identification to about 1 a.m.u. and electron intensities (relative or absolute) to 7- 20 %.Errors of TKE is 2 MeV.It was recorded 5*10(5) three-dimensional fission events.
Completion data:	Obtained: 1) integral and some a mass- sorted conversion electron energy spectra from fragments of thermal-neutron-induced fission of uranium-235, 2) the matrix of the conversion electron yield per fragment, depending on mass and total kinetic energy of fragments. Further analysis of experimental results is still in progress.

RUSSIA
(cont'd)

Discrepancies to other reported data: No such data available.

Publications:

1. Zuravlev O.K., Pelekhov U.I., Sergeev M.U., Prompt conversion electrons from primary fragments of uranium -235 fission by thermal neutrons, "Fiftieth Anniversary of Nuclear Fission", Proc. Int. Conf., Leningrad, 1989. St. Petersburg, 1992, vol.2, p.516-524.
2. Zuravlev O.K., Letarov U.A., Pelekhov U.I., Sergeev M.U., On the possibility of form isomerism in primary fragments with postneutron-emission mass A=87-88 from the uranium -233 fission induced by thermal neutrons, Soviet Journal of Nuclear Physics, 1991, vol.54, p.636-640.

RUSSIA

Laboratory and address:	Lensoviet Institute of Technology St. Petersburg 198013
Names:	V.F. Teplykh, E.V. Platygina, K.A. Petrzhak
Facilities:	Research reactor WWR-M, Betatron B-30, Neutron generator NG-200, mass-spectrometer MI-1201
Experiment:	Measurements of products yields for even nuclei: ^{233}U, ^{235}U, ^{236}U, ^{238}U, ^{239}Pu, ^{241}Pu, ^{242}Pu and odd nuclei: ^{238}Np, ^{243}Am and ^{244}Am fission, induced by neutrons and photons.
Method:	Relative and absolute yields of xenon (A=131-136) and krypton (A=83-86) isotopes were measured by means of mass-spectrometry.
Results:	Some earlier published results and recently acquired data on rare gas fission product yields are presented in the attached tables. Experimental evidence presented shows that mass yield curve fine structure within the studied product mass range both Z-even and Z-odd fissioning nuclei is caused mainly by nascent fragment's neutron and proton shells influence.
Accuracy:	Relative yields of xenon (A=131-136) isotopes are determined with accuracy better than 1%, except for ^{135}Xe, and the mean accuracy for krypton (A=83-86) isotopes is within 1÷2%.
Completion data:	1988
Publications:	K.A. Petrzhak, E.V. Platygina, V.F. Teplykh, *Proc. 5 All Union Conf. Neutron Phys.: Kiev, 1980/M., 1980, V.3, p. 171.* K.A. Petrzhak, E.V. Platygina, V.F. Teplykh et al., *Proc. 6 All Union Conf. Neutron Phys., Kiev, 1983/M., 1984, V.2, p. 251-253.* These results were presented at the Int. Conf. Fiftieth Anniversary of Nuclear Fission, Leningrad, USSR, Oct. 16-20, 1989.

TABLES

XENON ISOTOPES FISSION YIELDS

	Xenon isotopes yields, %				
Reaction	131	132	134	135	136
$^{238}Np(n_{th},f)$	0.406 ± .004	0.612 ± .005	1.000 ± .009	0.850 ± .030	1.011 ± .025
$^{241}Pu(n_{th},f)$	0.406 ± .004	0.611 ± .003	1.000 ± .005	0.984 ± .020	0.901 ± .005
$^{242}Pu(n_f,f)$	0.445 ± .002	0.631 ± .002	1.000 ± .003	-	0.926 ± .003
$^{243}Am(n_f,f)$	0.466 ± .003	0.643 ± .003	1.000 ± .004	-	1.011 ± .005
$^{244}Am(n_{th},f)$	0.484 ± .003	0.656 ± .004	1.000 ± .005	0.950 ± .030	1.120 ± .004

YIELDS OF XENON ISOTOPES IN FISSION OF URANIUM ISOTOPES

Comp. nucl.	Excitation energy, MeV	Xenon isotopes yields, % 131	132	134	136
^{234}U	6.84	0.533 ± .004	0.737 ± .004	0.928 ± .004	1.000 ± .004
^{235}U	10.1 *	0.635 ± .012	0.831 ± .016	1.131 ± .022	1.000 ± .020
^{236}U	6.54	0.458 ± .003	0.683 ± .004	1.244 ± .007	1.000 ± .006
^{237}U	6.6 **	0.511 ± .004	0.726 ± .004	1.170 ± .006	1.000 ± .006
^{238}U	10.3 *	0.619 ± .017	0.874 ± .020	1.104 ± .026	1.000 ± .025
^{239}U	6.3 **	0.466 ± .007	0.684 ± .007	1.065 ± .008	1.000 ± .009

*) Excitation energy was averaged on Shiff spectrum of 15-MeV bremsstrahlung (betatron B-30).
**) Excitation energy was estimated from averaged neutron spectrum data of LINF pile.

RELATIVE YIELDS OF KRYPTON ISOTOPES IN FISSION OF HEAVY NUCLEI BY PILE NEUTRONS

Target nucl.	Isotope yields, % 83	84	85	86
^{233}U	1.000 ± .005	1.654 ± .008	0.449 ±.003 (1.90) *	2.738 ± .019
^{235}U	1.000 ± .005	1.955 ± .023	0.502 ± .009 (2.13) *	3.730 ± .010
^{238}Np	1.000 ± .003	1.716 ± .013	0.385 ± .003 (1.63) *	2.921 ± .015
^{239}Pu	1.000 ± .005	1.634 ± .004	0.413 ± .002 (1.75) *	2.492 ± .010
^{241}Pu	1.000 ± .004	1.780 ± .009	0.411 ± .004 (1.74) *	2.936 ± .015
^{242}Pu	1.000 ± .005	1.395 ± .075	0.445 ± .005 (1.89) *	3.174 ± .017

*) In brackets - relative yields for A=85

RUSSIA

Laboratory and address:
Department of Primary Standards of Ionising Radiation Units,
D.I.Mendeleev Institute for Metrology(VNIIM),
19 Moskovsky Prospect, St-Petersburg 198005 Russia

Names:
T.E.Sazonova, G.A.Isaakyan, N.I.Karmalitsyn, A.A.Konstantinov,
S.V.Sepman, A.V.Zanevsky.

Facilities:
The experiments are based on accurate methods of absolute measurements of activity and X- and gamma photon flux density of radionuclide sources. These methods have been realized in our standard installations. The high accuracy of these methods has been proved by the International Comparison results according to the programs of the International Bureau of Measures and Weights (BIPM) with participation of the leading world metrological centers.

Experiment:

Method:
Absolute gamma-ray emission probabilities in the decay of Eu-154, Eu-155 and Cr-51 and Kx-ray emission probabilities in the decay of Cr-51, Y-88 and Se-75 have been determined using sources made of standard solutions. The activities of those radionuclides have been determined using the Kx-gamma coincidence method with two NaJ(Tl) scintillation counters of different thickness (for Cr-51, Y-88) and the extrapolation 4π(Kx+e-)-gamma coincidence method for radionuclides with complex decay scheme (Eu-154, Eu-155, Se-75). The X- and gamma-ray emissions of those sources were determined by the defined solid angle method using a NaJ(Tl) crystal and a calibrated Si and HPGe spectrometers.

Accuracy:
The uncertainties in the activity measurements ranged from 0.2% (for Cr-51 and Y-88) to 0.5% (for Eu-154, Eu-155 and Se-75), P=95%. The uncertainties in the X-ray emission measurements ranged from 0.6% (Y-88) to 1.3%-1.5% (Cr-51, Se-75), P=95%. The uncertainties in the gamma-ray emission measurements ranged from 0.9% (Cr-51) to 1.76% (Eu-154, Eu-155), P=95%. The total uncertainties of the absolute X- and gamma-ray emission probabilities ranged from 0.9% (Cr-51) to 1.8% (Eu-154, Eu-155), P=95%.

Completion date:
1994 for Cr-51, Y-88 and Se-75.

Discrepancies to other reported data are within their uncertainties.

Publications:
1. Sazonova,T.E., G.A.Isaakyan, N.I.Karmalitsyn, S.V.Sepman and A.V.Zanevsky. Nucl. Instr. and Meth. in Phys. Res. A312(1992),372.
2. Konstantinov,A.A., T.E.Sazonova, S.V.Sepman, A.V.Zanevsky and N.I.Karmalitsyn. Nucl. Instr. and Meth. in Phys. Res. in print.

RUSSIA

Laboratory and address:

Department of Primary Standards of Ionising Radiation Units,
D.I.Mendeleev Institute for Metrology(VNIIM),
19 Moskovsky Prospect, St-Petersburg 198005 Russia

Names:

A.E.Kochin, M.G.Kuzmina, I.A.Sokolova and P.L.Merson.

Facilities:

The experiments are based on accurate methods of absolute measurements of activity and beta flux density of radionuclide sources.

Experiment:

Method:

Measurement of the Sr-90 half-life was made in connection with the discovery of a systematic uncertainty associated with the half-life. The experiment was carried out using solid 90Sr+90Y sources containing minimal impurities. A standard setup with a 2π-counter was used. The interval between the first and second measurements was 5 years. The equipment for beta particle measurement was not changed during that period.

The half-life obtained is 29.2 years, with a standard deviation of 0.1 year.

Completion date: 1975-81

Publications: A.E.Kochin, M.G.Kuzmina, I.A.Sokolova and P.L.Merson, Metrologia 26,203-204(1989)

RUSSIA

LABORATORY AND ADDRESS	Moscow Engineering Physics Institute 115409, Moscow
1) NAMES	A.B.Koldobskii, V.M.Zhivun
FACILITY	Research reactor IRT, MEPI calibrated coaxial Ge(Li) detector
EXPERIMENT	Fragment yields from Th-229 thermal neutron fission.
METHOD	Semiconductor gamma-spectrometry of unseparated fission products.
RESULTS	Cumulative fission yields for 11 products.
ACCURACY	Approximately 10 %
COMPLETION DATE	completed
PUBLICATIONS	To be published in "Yadernaja Fizika"
2) NAMES	A.N.Gudkov, S.V.Krivasheev, A.B.Koldobskii, V.V.Kovalenko, E.Yu.Bobkov, V.M.Zhivun
FACILITY	Research reactor IRT, MEPI (thermal neutrons), Fast reactor at IPPE, Obninsk (fast neutrons), Neutron generator at Inst.Nucl.Phys., St. Petersburg (14.7 MeV neutrons) 24 BF_3 -counting tubes for delayed neutron detection
EXPERIMENT	Cumulative fission yields of delayed neutron precursors Br-87,8,9, Rb-93,4 and I-137,8,9 for the following fission reactions: thermal: Th-229, U-233,5, Cf-249 fast: U-233,5,6, Np-237, Pu-240,1, Am-241 14.7 MeV: U-233,5,6,8, Np-237, Pu242
METHOD	The (complex) decay curves of delayed neutron emitters were recorded and the method of incremental deconvolution was applied for their analysis.
ACCURACY	Approximately 10-40 %
COMPLETION DATE	completed
PUBLICATIONS	A.N.Gudkov et al, Radiochim.Acta 57 (1992) 69

RUSSIA

LABORATORY AND ADDRESS	1) Moscow Engineering Physics Institute 115409, Moscow 2) Institute fuer Kernchemie, Universtaet Mainz, Postfach 3980 D-55099 Mainz, Germany
NAMES	1) A.B.Koldobskii, S.V.Krivasheev, V.M.Zhivun, 2) H.O.Denschlag, R.Hentzschel.
FACILITY	Research reactor IRT, MEPI delayed neutron counter
EXPERIMENT	Delayed neutron group yields from Cm-245 thermal neutron fission.
METHOD	Delayed neutron registration by multiscale recording.
RESULTS	Measured delayed neutron yields in 6 group representation; evaluated odd-even effect in fission product charge distribution.
COMPLETION DATE	completed
PUBLICATIONS	To be published in "Radiochimica Acta"

SWEDEN

Laboratory and address: **University of Uppsala, The Studsvik Neutron Research Laboratory, S-61182 NYKÖPING, Sweden.**

Names: **G. Rudstam, E. Lund, P. Aagaard, K. Aleklett, L. Sihver**

Experiment: Yields of products from fast fission of ^{238}U.

Method: The techniques developed for the study of product yields in thermal fission of ^{235}U has been used also for the determination of yields in fast fission of ^{238}U. Thus, the amount of product nuclides formed in the irradiation of uranium with fast neutrons has been measured by means of gamma spectroscopy. The conversion of the number of atoms registered to fission yields requires the knowledge both of the delay in the isotope separator system and the separator efficiency for the element under study. Both these factors can be determined if the yields of two isotopes are known from other sources. Such normalization points are available for thermal fission of ^{235}U but are hard to find for the ^{238}U case. The problem has been overcome by means of a complementary experiment with ^{235}U instead of ^{238}U but with all other experimental conditions unchanged. The delay and separator efficiency obtained in the complementary experiment can then be used also for ^{238}U.

Completion date: The experimental part of the task is finished, and the analysis is well under way. It will be completed in the Spring of 1994.

Experiment: P_n-values and average kinetic energies of 60 delayed-neutron precursors.

Method: Neutron and beta activities have been measured simultaneously using multiscaling for the determination of P_n-values. A neutron detector with three concentric rings of BF_3-counters allowed the determination also of the average kinetic energy of the neutrons.

Completion date: The experiment is finished.

Publications: G. Rudstam, K. Aleklett, and L. Sihver, Atomic Data and Nuclear Data Tables **53**(1993)1.

G. Rudstam, K. Aleklett, and L. Sihver, Proceedings of a Specialists' Meeting on Fission Product Nuclear Data, Tokai, Japan, 25th–27th May 1992, NEA/NSC, DOC (92) 9 p. 115.

Experiment: Absolute gamma branching ratios for fission products.

Method: Beta activities and gamma spectra were measured simultaneously using calibrated detectors. The branching ratios were obtained for 89 nuclides among the fission products.

Completion date: The experiment is finished.

Publication: E. Lund, G. Rudstam and P. Aagaard, The Studsvik Neutron Research Laboratory Report NFL-76 (1993).

Experiment: Average beta and gamma energies of fission products in the mass range 98–108.

Method: The experiment was carried out at the LOHENGRIN mass separator at ILL in Grenoble in collaboration with scientists from Grenoble (ILL and CEN) and the Technical University of Braunschweig. Beta and gamma spectra were measured from the same sample. The main goal is to evaluate the average beta and gamma energy from the spectra, quantities required for the calculation of the decay heat in nuclear fuel using the summation method.

Completion date: The experimental part is finished, and the analysis of the results is under way. Final data are expected during 1994.

SWEDEN

Laboratory and address: University of Uppsala, The Studsvik Neutron Research Laboratory, S-61182 Nyköping, Sweden.

Names: B. Fogelberg, M. Hellström, D. Jerrestam, P.-I. Johansson, H. Mach and G. Rudstam. (University of Uppsala)
P. Hoff and J.P. Omtvedt. (University of Oslo, Norway)
K. Mezilev and Yu. Novikov. (St Petersburg University)

Facility: OSIRIS on-line mass separator for fission products.

1. Experiment: Spectroscopy of neutron-rich nuclides. Recent experiments include studies of ^{84,85}Ge, ^{84,85}As, $^{113-116}$Pd, $^{113-117}$Ag, ^{130,132}In, ^{134}Sb, ^{134}Te, ^{152}Pr, ^{152}Nd, ^{156}Pm.

Completion date: Indefinite

Publications:
B. Fogelberg *et al.*, Phys. Rev. C **41**,R1890 (1990)
M. Hellström *et al.*, Phys. Rev. C **41**,2325(1990)
B. Fogelberg *et al.* Z. Phys. A **337**,251(1990),
M. Hellström *et al.* Phys. Rev. C **43**,1462(1990)
J. P. Omtvedt *et al.* Z. Phys. A **338**,241(1991)
P. Hoff *et al.* Z. Phys. A **338**,285(1991)
J. P. Omtvedt *et al.* Z. Phys. A **339**,349(1991)
M. Hellström *et al.* Phys Rev. C **46**,860(1992)
H. Mach *et al.* Phys. Rev. C **46**,1849(1992)
M. Hellström *et al.* Phys. Rev. C **47**,545(1992)

2. Experiment: Total β–decay energies and Atomic Masses.

Method: A small Ge–detector is used as a β–spectrometer in $\beta\gamma$–coincidence experiments. The respons function of the detector has been accurately determined using mono–energetic electrons up to an energy of 8.5 MeV. A large number of Q_β–values in the region near ^{132}Sn are presently being analyzed and prepared for publication.

SWITZERLAND

Laboratory: Institut d'Electrochimie et de Radiochimie
Ecole Polytechnique Fédérale de lausanne
CH 1015 Lausanne

presently,

Office Fédéral de Métrologie
Institut de Radiophysique Appliquée
Centre universitaire
CH 1015 Lausanne

Name: J.-J. Gostely

Facilities: Well-type high pressure ionization chamber

Experiment: The half-life of ^{137}Cs has been found to be 10,940.8 ± 6.9 d.

Method: A ^{137}Cs source was measured in an ionization chamber for 3000 d relative to a well defined ^{226}Ra source.

Accuracy: ± 0.06 %

Completion date: September 1991

Discrepancies to: The present value is 3.9 standard deviations lower than (10,967.8 ±4.5 d) published recently by Martin and Taylor using similar equipment and fitting procedure (1990 Nucl. Instrum. methods A286, 507).

Publication: J.-J. Gostely, Appl. Radiat. Isot. 43 (1992) 949-951.

TAIWAN

Laboratory and Address:	Institute of Physics Academia Sinica Nankang, Taipei 115 Taiwan, R.O.C.
Names:	G.C. Kiang, L.L. Kiang (Nat'l. Tsing-Hua University), P.K. Teng G.C. Jon, E.K. Lin, C. W. Wang.
Facilities:	3 MV 9SDH-2 Pelletron, Anti-Compton $\gamma-$ray spectrometer, μ VAX II + CAMAC + Fast NIM data acquisition system, HpGe, surface barrier and multi-stripe position sensitive detectors, NaI(Tl) and Plastic Scintillators.
Experiments:	In-beam $\gamma-$ray spectroscopy, radioactivity.
Methods:	The (p, γ), (d, pγ), (α, pγ) and (n, γ) reactions $\gamma-$rays are detected by the HpGe detectors, HpGe-NaI(Tl) Compton Suppression Spectrometer, and the charged particle are detected by the Surface Barrier and Multi-stripes position sensitive detectors. Singles γ, $\gamma - \gamma$, $\gamma-$charged particle coincidence spectra and directional correlation functions are measured. The lifetime of excited states are measured by DSAM. To measure the $\gamma-$decay of the radioactive samples which are neutron irradiated at Nat'l. Tsing-Hua University 1 MW reactor.
Accuracy:	Typically, the total error is under 8%.

TAIWAN (cont'd)

Publications:

1) G.C. Kiang, L.L. Kiang, P.K. Teng, T.H. Yuan, W.F. Niu, I.M. Hsu, and W.S. Chang, A computer code for gamma spectroscopy, Nucl. Sci. J., **28**, 1 (1991).

2) G.C. Kiang, L.L. Kiang, P.K. Teng and H. Orihara, 6^-, T=1 stretched states in ^{24}Al and ^{28}P via ^{24}Al(p, n) and ^{28}Si(p, n) reactions at 35 MeV, Proc. Nat'l. Sci. Counc. ROC (A), **16**, 108, (1992).

3) L.L. Kiang, W.C. Lin, Empirical relation between efficiency and volume of HPGe detector by Monte Carlo calculation, App. Radiat. Isot.**44**, 813, (1993).

4) L.L. Kiang, G.C. Kiang, P.K. Teng, W.S. Chang and P.J. Tu, Studies on the level structure of ^{110}Cd via the $\beta-$decay of ^{110m}Ag nucleus, J. of Phys. Soc. Japan, **62**, 888, (1993).

5) L.L. Kiang, R.H. Tsou, W.J. Lin, Simon C. Lin, G.C. Kiang, P.K. Teng and S.D. Li, A study on T-shape Compton suppression spectrometer by Monte Carlo simulation, Nucl. Instr. & Meth., **A327**, 427 (1993).

6) G.C. Kiang, L.L. Kiang, P.K. Teng, G.C. Jon, R.H. Tsou and Yen-Chu Chen, A CAMAC based event-by-event data acquisition system for low energy nuclear studies, Chinese J. of Phys., **31**, 643, (1993).

UKRAINE

Laboratory and adress:	Kharkov State University. 310077 Kharkov, Svoboda sq., 4. Ukraine.
Names:	P.M.Gopych, I.I.Zalyubovskii, P.S.Kizim, A.F.Shchus
Facilities:	Neutron Generator NG-150M, Ge(Li) gamma ray spectrometer, transport pneumatic system, enriched tin-112,114,116,118,120,122,124
Experiment:	At the neutron energy of 14.6 ± 0.2 MeV the partial cross sections of (n,p), (n,α), (n,d)+(n,np)+(n,pn) reactions on even tin isotopes with A = 112-122 are mesured. Experiments with ^{124}Sn are now in progress.
Method:	Activation technique
Accuracy:	10-50%
Completion date:	1994
Discrepancies to other reported data:	For 12 measured cross section values no other data have been reported. A new effect of regular spin splitting of nuclear reaction cross sections was found.
Publications:	1. P.M.Gopych e.a. Regular spin splitting of (n,p) reaction cross sections on tin isotopes. Yadernaya Fizika, v.47,1988, pp.602-603. 2. P.M.Gopych e.a. Regular spin splitting of nuclear reaction cross sections induced by 14 MeV neutrons. Pis'ma v JETF,v.50,1989,pp.273-275 (JETP Lett.,v.50,1989,pp.302-306).

UKRAINE

Laboratory and adress:	Kharkov State University. 310077 Kharkov, Svoboda sq., 4. Ukraine.
Names:	P.M.Gopych, I.I.Zalyubovskii, P.S.Kizim, A.F.Shchus
Facilities:	Neutron Generator NG-150M, Ge(Li) gamma ray spectrometer, enriched tellurium-122,124,126
Experiment:	At the neutron energy of 14.6 ± 0.2 MeV eleven partial cross sections of (n,p) reaction on even tellurium isotopes with A = 122-130 and cross section of (n,α) reaction on tellurium 126 have been measured.
Method:	Activation technique
Accuracy:	10-30%
Completion date:	Completed
Discrepancies to other reported data:	For ^{122}Te(n,p)^{122}Sb(4.2m), ^{124}Te(n,p)^{124}Sb(20.2m), ^{124}Te(n,p)^{124}Sb(93.0s) no other data have been reported. The partial cross sections isotope systematics of Te(n,p)Sb and Sn(p,n)Sb reactins appeared to be similar.
Publications:	P.M.Gopych, I.I.Zalyubovskii, P.S.Kizim, V.I.Sorokin, V.V.Sotnikov, A.F.Shchus. Regular spin splitting of (n,p) reaction cross sections on tellurium isotopes. Yadernaya Fizika, v.57, No.3, 1994, pp.1-11.

UKRAINE

Laboratory and adress:	Kharkov State University. 310077, Kharkov, Svoboda sq., 4. Ukraine
Names:	P.M.Gopych, I.I.Zalyubovskii, P.S.Kizim
Facilities:	Neutron Generator NG-150M, Ge(Li) gamma ray spectrometer
Experiment:	The partial cross section $\sigma = 10 \pm 2$ mb for $^{126}Te(n,\gamma)^{127g}Te$ reaction and isomeric ratios σ^m/σ^g for (n,γ) reactons on $^{126,128,130}Te$ at the neutron energy of 2.6 ± 0.3 MeV have been measured
Method:	Activation technique
Accuracy:	20%
Completion date:	Completed
Descrepancies to other reported data:	No other data have been reported
Publications:	P.M.Gopych, I.I.Zalyubovskii, P.S.Kizim, V.I.Sorokin, V.V.Sotnikov, E.A.Fomin. Isotope systematics of (n,γ) cross sections for even tellurium isotopes. Atomnaya Energiya, v.74, No.1,1993,pp.78-79 .

UKRAINE

Laboratory and adress: Kharkov State University. 310077, Kharkov, Svoboda sq., 4. Ukraine

Names: P.M.Gopych, M.N.Demchenko, I.I.Zalyubovskii, P.S.Kizim

Facilities: Neutron Generator NG-150M, Ge(Li) gamma ray spectrometer, enriched cadmium-114

Experiment: At the neutron energy of 14,6 $\pm$ 0,2 MeV the partial cross section σ = 0.4 $\pm$ 0.1 mb of ^{114}Cd[(n,d)+(n,np)+(n,pn)]^{113m}Ag($T_{1/2}$ = 1,15 m) reaction is measured

Method: Activation technique

Accuracy: 25%

Completion date: Completed

Descrepancies to other reported data: No other data have been reported. Applying isotope systematics the partial cross sections for 17 (n,d)+(n,np)+(n,pn) reactions on cadmium and tin isotopes are estimated.

Publications: P.M.Gopych, M.N.Demchenko, I.I.Zalyubovskii, P.S.Kizim, S.I.Panasenko. Cross sections of (n,d)+(n,np)+(n,pn) reaction on even cadmium and tin isotopes at the neutron energy of 14 MeV. Atomnaya Energiya, v.75,No.3,1993,pp.233-235.

UNITED KINGDOM

Laboratory:	National Physical Laboratory, Division of Radiation Science and Acoustics Teddington TW11 0LW United Kingdom
Names:	D Smith, D H Woods, S A Woods, M J Woods, J L Makepeace
Facilities:	Calibrated Ge, 4π beta-gamma coincidence counter, beta-spectrometer, ionisation chamber
Experiment:	To measure absolute gamma-ray emision probabilities of ^{125}Sb, ^{154}Eu and ^{124}I. For ^{124}I, the half-life and positron emission probability and details of beta spectrum were also measured.
Method:	Standardisation of the nuclides by coincidence counting and measurement of gamma-emissions by calibrated gamma spectrometers. Half-life measured by following decay over 5 half-lives by ionisation chamber. Positron emission measured by gamma spectrometry using an annihilator to localise 511 keV radiation, with calibration by ^{22}Na source of known activity plus various corrections. Beta spectrum end-points and shapes measured by iron-free beta spectrometer.
Accuracy:	Gamma-emission probabilities- various, 0.5% or more. Half-life ^{124}I- 4.1760(3) days. Positron emission probability ^{124}I- 0.2162(41)
Completion data:	Completed
Publication:	1)Standardisation of ^{125}Sb and ^{154}Eu, and measurement of absolute gamma-ray emission probabilities. D Smith, D H Woods, J L Makepeace, R A Mercer and C W A Downey, Nucl. Instrum. and Meth. in Phys. Res. A312 (1992) 353 2)The standardisation and Measurement of decay scheme data of ^{124}I. D H Woods, S A Woods, M J Woods, J L Makepeace, C W A Downey, D Smith, A S Munster, S E M Lucas and H Smarma Appl. Radiat. Isot. 43 (1992) 551

U.S.A.

Laboratory and address:	Argonne National Laboratory 9700 South Cass Avenue Argonne, Illinois 60439, U.S.A.
Author:	A. B. Smith
Facilities:	Argonne National Laboratory 8 MeV tandem and associated time-of-flight facilities.
Experiment:	studies of the fast-neutron interaction with fission product nuclei.
Recent Work:	1. Fast-neutron interaction with vibrational cadmium nuclei, Argonne National Laboratory Report ANL/NDM-127 (1992). 2. Fast-neutron interaction with the fission product ^{103}Rh, Argonne National Laboratory Report ANL/NDM-130 (1993). 3. Fast-neutron scattering from vibrational palladium nuclei, Argonne National Laboratory Report ANL/NDM-131 (1993).
Planned Work:	Studies of the fast-neutron interaction with tin, antimony, yttrium, gadolinium, rhenium and hafnium. Projected completion in 1994.

U.S.A.

Laboratory and Address:	Idaho National Engineering Laboratory EG&G Idaho, Inc. P. O. Box 1625 Idaho Falls, ID 83415-2114 USA
Names:	R. C. Greenwood, C. W. Reich, K. D. Watts, H. Willmes (U. Idaho)
Experiment:	Nuclear decay properties ($T_{1/2}$, decay energies, β-branching, γ-branching) of short-lived fission products.
Facility:	INEL ^{252}Cf-based ISOL facility.
Method:	On-line mass separations followed by γ, γ-γ, β and β-γ measurements.
Measurements Completed:	Decay studies for $^{153-155}$Nd, $^{153-157}$Pm and ^{157,158}Sm.
Publications:	"Measurement of β^- End-point Energies using a Ge Detector with Monte Carlo Generated Response Functions," R. C. Greenwood and M. H. Putnam, to be published in Nucl. Instrum. and Methods. "Nuclear Decay Studies Of Fission-product Nuclides using an On-line Mass Separation Technique," R. A. Anderl and R. C. Greenwood, J. Radioanal. and Nucl. Chem., Articles 142, 203 (1990).

U.S.A.

Laboratory and Address:	Idaho National Engineering Laboratory EG&G Idaho, Inc. P. O. Box 1625 Idaho Falls, ID 83415-2114 USA
Names:	R. C. Greenwood, K. D. Watts
Experiment:	Delayed-neutron energy spectral measurements of fission-product isotopes.
Facility:	TRISTAN ISOL system at Brookhaven National Laboratory
Method:	Isotope separation on line with gas-filled proton-recoil proportional counters and liquid scintillation detectors used to measure delayed-neutron spectra.
Measurements Completed:	Initial measurements and data analysis completed for $^{87-90}Br$, $^{137-139}I$ and ^{136}Te. Final measurements to be completed during Spring 1994.
Publications:	No recent publications.

U.S.A.

Laboratory and Address: Idaho National Engineering Laboratory
EG&G Idaho, Inc.
P. O. Box 1625
Idaho Falls, ID 83415-2114 USA

Names: R. C. Greenwood, R. G. Helmer, M. H. Putnam, K. D. Watts

Experiment: Beta-decay feeding (β- strength) distributions of short-lived fission-product isotopes.

Facility: INEL ^{252}Cf-based ISOL facility.

Method: Measurement of the distribution of β-decay feeding intensities of fission product decay nuclides using a total absorption γ-ray spectrometer (TAGS).

Measurements Completed: Specific fission-isotope decays for which TAGS spectral measurements have been made, to date, include all nuclides with Z = 55 to 60 and A = 138 to 151, with decay half-lives in the range of ~10 s, up to 2 hr, together with some of the lighter mass Rb, Sr and Y nuclides.

Publications:

"β^- Feeding Distributions for $^{138-141}Cs$ from Total Absorption γ-ray Spectrometer (TAGS)," R. G. Helmer, R. C. Greenwood, K. D. Watts and M. H. Putnam, in 1993 ICRM Intern. Symp. on Radionuclide Metrology and its Applications, June 7-11, 1993, Teddington, UK, to be published in Nucl. Instrum, and Methods.

"Measurement of Beta-decay Strength Distributions of Fission-product Isotopes Using a Total Absorption Gamma-ray Spectrometer," R. C. Greenwood, R. G. Helmer, M. A. Oates, M. H. Putnam, and K. D. Watts, in Nuclear Data for Science and Technology, ed. S. M. Qaim, (Springer-Verlag, 1992) p. 548.

"Use of a Total Absorption Gamma-ray Spectrometer to Measure Ground-state β^- - branching Intensities," R. C. Greenwood, D. A. Struttman and K. D. Watts, Nucl. Instrum, and Methods A317, 175 (1992).

"Total Absorption Gamma-ray Spectrometer for Measurement of Beta-decay Intensity Distributions for Fission-product Radionuclides," R. C. Greenwood, R. G. Helmer, M. A. Lee, M. H. Putnam, M. A. Oates, D. A. Struttmann and K. D. Watts, Nucl. Instrum. and Methods A314, 514 (1992).

U.S.A.

Laboratory and Address:	Idaho National Engineering Laboratory EG&G Idaho, Inc. P. O. Box 1625 Idaho Falls, ID 83415-2114 USA
Names:	R. Aryaeinejad, J. D. Cole, R. C. Greenwood
Experiment:	Study of moderately high-spin states in neutron-rich nuclei via spontaneous fission of ^{252}Cf and ^{242}Pu.
Facility:	ORNL compact ball consisting of 20 Compton-Suppressed Ge Detectors. INEL spectrometer consisting of 2 X-ray, 3 Ge, and 8 Neutron detectors.
Method:	Measurements of γ-γ, X-γ, n-γ and γ-γ-γ for prompt gamma-rays emitted by spontaneous fission sources.
Measurements Completed:	Two measurements at ORNL with ^{252}Cf and ^{242}Pu sources using the compact ball. One measurement at INEL with ^{252}Cf using the INEL spectrometer.
Analysis Completed:	High spin states and band crossing in ^{112}Pd, ^{114}Pd, and ^{116}Pd isotopes. Excited states in ^{136}Te, ^{138}Xe, ^{40}Xe, and ^{140}Ba nuclei.
Publications:	"Band crossing observed in neutron-rich Pd isotopes via spontaneous fission of ^{252}Cf," R. Aryaeinejad, J. D. Cole, R. C. Greenwood, K. Butler-Moore, S. Zhu, J. H. Hamilton, A. V. Ramayya, X. Zhao, W. C. Ma, J. Kormicki, J. K. Deng, W. B. Gao, I. Y. Lee, N. R. Johnson, F. K. McGowan, G. Terakopian, Y. Oganessian. Phys. Rev. C48, 566(1993). "Levels in ^{136}Te and new high-spin states in neutron-rich N=84 isotones." K. Butler-Moore, J. H. Hamilton, A. V. Ramayya, S. Zhu, X. Zhao, W. C. Ma, J. Kormicki, J. K. Deng, W. B. Gao, J. D. Cole, R. Aryaeinejad, I. Y. Lee, N. R. Johnson, F. K. McGowan, G. Ter-Akopian, Y. Oganessian. J. Phys. G. Nucl. Part. Phys. 19, L121-L126 (1993).

U.S.A.

Laboratory:	Oak Ridge National Laboratory P.O. Box 2008, MS 6356 Oak Ridge, Tennessee, 37831-6356, USA
Names:	J. K. Dickens, S. Raman and B. D. Murphy
Facilities:	Dounreay Prototype Fast Reactor
Experiment:	cumulative fission yields from long irradiations Three specially prepared fuel rods(FP-1, FP-2 and FP-4), each containing 24 actinide samples, were irradiated in the Dounreay PFR. Two of the rods were irradiated for the equivalent of 63 full power days. The third rod was irradiated for the equivalent of 488 full power days. The principal isotopes in the exposed samples were Th-230 and 232, U-233, 234, 235, 236 and 238; Np-237; Pu-238, 239, 240, 241, 242 and 244; Am-241 and 243; and Cm-243, 244, 246 and 248. All fuel pins have been examined using high-resolution gamma-ray spectrometry. The first two pins were used in preparatory studies and preliminary studies have been done on fission products in the more heavily exposed third pin. Fission products studied were Ru-106, Ag-110m, Sb-125, Cs-134, Cs-137, Ce-144, Eu-152, Eu-154 and Eu-155.
Accuracy:	For FP-1: between 4% and 60% For FP-2: between 3% and 15% For FP-4: currently being determined.
Completion Date:	December 1994.
Discrepancies:	Cs-137 values compare reasonably well with calculations. Some of the other fission products show variability but can probably be explained in terms of measurement and chemical analysis difficulties.
Publications:	Pending.

U.S.A.

Laboratory and Address:

Pacific Northwest Laboratory
P. O. Box 999, MS P8-08
Richland, WA 99352

Names:

Paul L. Reeder

Facilities:

TISOL - On-Line Mass Separator with ECR Ion Source
TRIUMF - 500 MeV Proton Accelerator

Experiment:

Measurement of beta-decay properties of very neutron-rich Kr, Xe, and Rn nuclides.

- Beta-decay half-life ($t_{1/2}$)
- Delayed-neutron emission probability (P_n)
- Average energy of delayed-neutron spectrum
- Delayed-neutron energy spectra

Method:

The Kr, Xe, and Rn nuclides are produced by bombarding a ^{238}U target with protons. Gaseous species diffuse out of the target through a cool transfer line to an ECR ion source. The TISOL on-line mass separator selects the mass number of interest and deposits the ion beam on a movable tape inside a plastic scintillator beta detector. The beta detector and tape system are surrounded by a polyethylene-moderated neutron counter with 40 ^3He counter tubes. Beta, neutron, and beta-neutron coincidence count rates are measured simultaneously in a computer-based multi-scaling system. Neutron efficiency calibrations are based on nuclides such as ^8He with known P_n values.

Accuracy:

The goal is to improve the accuracy of both $t_{1/2}$ and P_n values for all Kr nuclides with A >92 and Xe nuclides with A >141. It should be possible to extend the measurements to 2 mass numbers beyond the presently known nuclides. Beta half-lives for unknown $^{229-232}Rn$ will be studied.

Completion Date:

Preliminary data were obtained in July, 1993. Improved data are expected in the summer of 1994 for $t_{1/2}$ and P_n measurements. Energy spectra measurements are planned for the summer of 1995.

Discrepancies to other reported data:

Not available

Publications:

none

1.2 COMPILATIONS AND EVALUATIONS

BELGIUM

Laboratory and address: Nuclear Physics Laboratory
Proeftuinstraat 86
B9000 Gent, Belgium

Names: D. De Frenne, E. Jacobs

Evaluation: Nuclear Data Sheets for A=102, 103, 105, 106, 110 and 112
Last evaluation of A=103 was, due to lack of time, done by J. Blachot (CENG-Grenoble)

Purpose: to give a critical survey of all available information concerning A=102, 103, 105, 106, 110, and 112 nuclei, and derivation of consistent best or preferred values with their uncertainties

Method : Cfr. Nuclear Data Project

Major sources of information: Recent references of NDP

Deadline of literature coverage: 102: July 1990
103: June 1992
105: May 1992
106: June 1993
110: November 1991
112: June 1988

Computerfile of available data: ENSDF

Completion date : 102: June 1991
103: January 1993
105: February 1993
106: 1994
110:August 1992
112: August 1989

Publications: D. De Frenne, E. Jacobs, Nucl. Data Sheets 63, 373 (1991)
D. De Frenne, E. Jacobs, Nucl. Data Sheets 68, 935 (1993)
D. De Frenne, E. Jacobs, Nucl. Data Sheets (1994) to be published
D. De Frenne, E. Jacobs, Nucl. Data Sheets 67, 809 (1992)
D. De Frenne, E. Jacobs, and M. Verboven, Nucl. Data Sheets 57, 443 (1989)

CHINA

Laboratory and Adress :	Chinese Nuclear Data Center Institute of Atomic Energy P.O. Box 275(41) Beijing 102413, China
Name :	Wang Dao
Purpose :	To provide fission yields for decay heat calculation
Evaluation :	An effort to update the fission yields of 87′version is carrying out. A complete statement of uncertainties in data is given by the covariance matrix, of which the diagonal elements are the variances of uncertainties, and the off–diagonal elements describe the correlations among the data. A complete covariance matrix is useful in estimating the best value and the reasonable uncertainty. As an improvement to the traditional evaluation method,the covariance technique has been used. Reference values are the base point of evaluated experimental data, and are used widely, which involve in (1) the whole set of data in U^{235} thermal fission, and (2) all the fission yields concerning the fission products which generally are taken as reference nuclides. At present, the evaluation related to reference yields is in progress.
Compilation:	To compile fission yields for international EXFOR fission yield data base.
Calculation :	Decay heat of fission products for testing the recommended values of fission yields through comparing calculated decay heat data with measured ones.
Status :	Under work
Computer file of evaluated data :	The fission yields of 87′version are available from the IAEA Nuclear Data Section (IAEA–NDS–91).
Publication:	Wang Dao, Covariances in fission yield evaluation for CENDL, the Proceedings of NEANDC Specialists′ Meeting on Fission Product Nuclear Data,Japan, 25th – 27th May 1992

INDIA

Laboratory and address: Department of Physics, Panjab University, CHANDIGARH-160014, India.

Names: Raj K. Gupta

Evaluation: (i)Charge distribution yields in spontaneous fission of U-236 and Cf-252. (ii)Correlation of charge and mass distributions. (iii) New cluster radioactivity vs. cold fission.(iv)Synthesis of new and super-heavy elements via cluster decay.

Purpose: To predict and study the fine structure of the charge distribution yields, correlation of charge and mass distributions in fission, and the exotic cluster emission as cluster decay or fission process, the cluster radioactivities other than Pb radioactivity, and the possible nuclear structure effects in nuclei decaying via cluster emission.

Method:

i) Charge distribution yields are obtained by solving stationary Schroedinger equation. The width of distribution, the most probable charge and the odd-even effects are also calculated.

ii) Time dependent Schroedinger equation in charge, and in coupled charge and mass asymmetry & relative separation coordinates are solved analytically to obtain, respectively, the charge distribution yields and to study the time evolution of centriods and variances and their correlation coefficient in fission.

iii) A cluster preformation model of cluster radioactivity is proposed, where cluster preformation probability is the quantum mechanical probabilty on collective model basis.

Major sources of information: Journals and reports at national/international conferences and schools.

Deadline of literature covered: March 1994.

Status:

i) Fine structure effects in charge distribution yields of light mass products of U-236 are observed to give rise strong proton odd-even effects due to shell effeets in both potentials and masses. Additional proton odd-even effects due to coupling of charge asymmetry to relative coordinate is also observed.

ii) The degree of neutron-proton correlation in spontaneous fission of U-236 is found to depend strongly on time. At very small times the neutro-proton motion is uncorrelated, which becomes correlated at larger times.

iii) Cluster formation in radioactive nuclei is a quantum mechanical fragmentation process, like in normal fission.

iv) Super-asymmetric fission is shown to be more probable than cluster decay process.

v) A new Sn-daughter A=4n cluster radioactivity in predicted in Xe, Ba, Ce, nuclei.

vi) Deformed-daughter cluster radioactivity is predicted in Hg-isotopes.

Publications:

1. D.R. Saroha, R. Aroumougame & R.K. Gupta, Phys. Rev. **C27** (1983) 2720.
2. D.R. Saroha and R.K. Gupta, Phys. Rev. **C29** (1984) 1101.
3. R.K. Gupta and D.R. Saroha, Phys. Rev. **C30** (1984) 395.
4. R.K. Gupta, D.R. Saroha and N. Malhotra, J. de Physique Coll. **45** (1984) C6-477.
5. D.R. Saroha and R.K. Gupta, J. Phys. **G 12** (1986) 1265.
6. R.K. Gupta, S. Gulati, S.S. Malik and R. Sultana, J.Phys. **G 13**(1987)L27
7. R.K. Gupta, S.S. Malik and R. Sultana, Fizika **19** (1987) 23 (Supplement 1).
8. S.S. Malik, S. Singh, R.K. Puri, S. Kumar & R.K. Gupta, Pramana J.Phys. **32**(1989)419
9. S.S. Malik and R.K. Gupta, Phys. Rev. **C39** (1989) 1992.
10. R.K. Puri, S.S. Malik and R.K. Gupta, Europhys. Lett. **9** (1989) 767.
11. R.K. Gupta, W. Scheid and W. Greiner, J. Phys. **G 17** (1991) 1731.
12. S. Singh, R.K. Gupta, W. Scheid and W. Greiner, J. Phys. **G 18** (1992) 1243.
13. A. Sandulescu, R.K. Gupta, F. Carstoiu, M. Horoi and W. Greiner, Int. J. Mod. Phys. **E1** (1992) 379.
14. R.K. Gupta, S. Singh, R.K. Puri, A. Sandulescu, W. Greiner and W. Scheid, J. Phys. **G 18** (1992) 1533.
15. R.K. Gupta, S. Singh, R.K. Puri and W. Scheid, Phys. Rev. **C47** (1993) 561.
16. J. Cseh, R.K. Gupta and W. Scheid, Phys. Lett. **B299** (1993) 205.
17. R.K. Gupta, M. Horoi, A. Sandulescu, M. Greiner & W. Scheid, J.Phys.**G19**(1993)2063
18. S. Kumar, R.K. Gupta and W. Scheid, Int. J. Mod. Phys. **E3** (1994) No. 1.
19. R.K. Gupta and W. Greiner, Int. J. Mod. Phys. **E3** (1994) No. 1.
20. S. Kumar and R.K. Gupta, Phys. Rev. **C49** (1994) No. 4.

JAPAN

Laboratory and address:

Japanese Nuclear Data Committee
Decay Heat Evaluation Working Group
c/o Nuclear Data Center
Japan Atomic Energy Research Laboratory
Tokai-mura, Naka-gun, Ibaraki-ken 319-11
Japan

Members:

R. Nakasima (Hosei Univ.), M. Yamada, T. Tachibana (Waseda Univ.),
T. Katoh, K. Tasaka (Nagoya Univ.), T. Yoshida (Toshiba),
Y. Kaise (MAPI), A. Zukeran (Hitachi), T. Murata (NFD)
H. Ihara, J.Katakura (JAERI), I. Ohtake (Data Engineering)

Compilation and Evaluation

Purpose:

To improve the present version of the JNDC FP Nuclear Data Library, Version 2, completed in 1989.

Major Source of Information:

Journals, Nuclear Data Sheets, ENSDF and theoretical calculations

Status:

JNDC FP Nuclear Data Library Version 2 was completed in 1989. To study the feasibility of the further improvement of the library, basic investigations were carried out. Points were placed on improving the reproducibility of energy spectra of the beta-ray, the gamma-ray and the derayed neutrons from the aggregate fission products.

Availability of the Data:

Contact Dr. Y. Kikuchi
General Manager, Nuclear Data Center,
Japan Atomic Energy Research Institute
Tokai-mura, Ibaraki-ken 319-11, Japan

Publications:

1. K.Tasaka, J.Katakura, H.Ihara, T.Yoshida, S.Iijima, R.Nakasima, T.Nakagawa and H.Takano, "JNDC Nuclear Data Library of Fission Products -Second Version-," JAERI 1320 (1990)
2. A.Zukeran, H.Ihara and T.Nakagawa, J.Nucl.Sci.Technol., **28** (1991) 791
3. S.Iijima, T.Yoshida, K.Tasaka, T.Katoh, J.Katakura, and R.Nakasima, Proc. Conf. Nucl. Data for Sci. Tech., May 1991, Juelich, p.542
4. K.Tasaka et al., J.Nucl.Sci.Technol., **28** (1991) 1134
5. J.Katakura and S.Iijima, ibid., **29** (1992) 11
6. K.Tasaka et al., ibid., **29** (1992) 303
7. T.Katoh, K.Tasaka and T.Yoshida, J.Atom.Eng.Soc.Jp., **35** (1993) 33 (in Japanese)

Japan

Laboratory and address : Japanese Nuclear Data Committee/FP Nuclear Data W.G., Japan Atomic Energy Research Institute, Tokai-mura, Naka-gun, Ibaraki-ken 319-11, Japan

Name : M. Kawai (i), S. Chiba, T. Nakagawa, Y. Nakajima, T. Sugi (ii) H. Matsunobu (iii), A. Zukeran (iv), T. Watanabe (v) and M. Sasaki (vi)

Evaluation : (1) Re-evaluation of neutron data of the following 172 FP nuclides in the FP region for JENDL-3.2:

As-75, Se-74, 76, 77, 78, 79, 80[b], 82, Br-79[c], 81[c], Kr-78, 80, 82, 83, Kr-84, 85, 86, Rb-85, 87, Sr-86, 87, 88[b], 89, 90[a], Y-89[b], 91, Zr-90[abd], 91, 92[d], 93, 94[d], 95, 96[d], Nb-93[b], 94, 95, Mo-92[d], 94[d], 95[d], Mo-96[d], 97[d], 98[d], 99, 100[d], Tc-99[b], Ru-96, 98, 99[b], 100, 101[d], 102, Ru-103, 104, 106, Rh-103[bd], 105, Pd-102, 104, 105, 106, 107[b], 108, Pd-110, Ag-107[b], 109[b], 110m, Cd-106, 108, 110[b], 111[bc], 112, 113[b], Cd-114, 116, In-113, 115[c], Sn-112, 114, 115, 116, 117[c], 118, 119, Sn-120, 122, 123, 124[c], 126, Sb-121[cd], 123[cd], 124, 125, Te-120, 122[bc], Te-123[c], 124[bc], 125[b], 126[b], 127m, 128, 129m, 130, I-127[b], 129, 131, Xe-124, 126, 128, 129, 130, 131, 132, 133, 134, 135, 136, Cs-133, 134, Cs-135, 136, 137[ab], Ba-130, 132, 134, 135[b], 136, 137[b], 138[bc], 140, La-138, 139[b], Ce-140[b], 141, 142[c], 144, Pr-141[b], 143, Nd-142[b], 143[b], Nd-144[b], 145[b], 146, 147, 148, 150[d], Pm-147, 148g, 148m, 149, Sm-144[bd], 147[b], 148[cd], 149, 150[cd], 151, 152[d], 153, 154[bd], Eu-151, 152, Eu-153, 154[ab], 155[ab], 156, Gd-152, 154, 155, 156, 157, 158, 160, Tb-159.

N.B. a) Thermal cross sections were modified.
b) Resonance parameters were modified.
c) Capture cross sections above the resolved resonance region were renormalized to the new experimental data.
d) Inelastic scattering cross sections were modified.

(2) Integral test of the JENDL-3 data in the FP region.

(i) Toshiba Corporation. (ii) Japan Atomic Energy Research Institute.
(iii) Sumitomo Atomic Energy Industries, Ltd. (iv) Hitachi Ltd.
(v) Kawasaki Heavy Industries, Ltd. (vi) Mitsubishi Atomic Power Industry Inc.

Japan

(cont'd)

Purpose : Fast breeder reactor and thermal reactor calculation.

Method : (1) Calculation of the capture, elastic and inelastic scattering and total cross sections was made with the spherical optical model and statistical theory. The Multi-level Breit-Wigner formula was adopted in the resonance region. Unassigned neutron angular momentum were determined with the Bayesian theorem according to resonance statistics. Unresolved resonance parameters were given in the energy region up to 100 keV.

(2) Threshold reaction cross sections such as (n,2n), (n,p), (n,α), (n,np), (n,nα) cross sections were evaluated by using the simple evaporation and pre-equilibrium model calculation code, PEGASUS. Direct inelastic scattering cross sections for even-mass isotopes were calculated with the DWBA theory for one-phonon transition states and with the coupled channel theory for rotational band of Nd and Sm isotopes. Semi-direct and direct capture contribution was added.

(3) Re-evaluation was made for resonance parameters, and capture and inelastic scattering cross sections. The results of integral tests on the JENDL-3 FP data were taken into account in the re-evaluation.

(4) The integral test was performed using the JAERI-FAST type 70-group cross sections for the integral data measured at STEK, CFRMF and EBR-II. Covariances of the neutron fluxes and the evaluated cross sections were considered.

(5) For the STEK experiments, neutron spectra in the core were exactly calculated with the vectorized Monte Carlo code, MVP, and the influence of their accuracy on the sample reactivity worth were examined.

Major sources of information : EXFOR Library, CINDA, resonance parameters recommended by Mughabghab et al. and recent literature. Integral data from STEK, CFRMF and EBR-II.

Status : (1) The JENDL-3 FP Library was released in December 1990.

(2) The JENDL-3.2 compilation is on the final stage.

(3) The generation of group cross sections from JENDL-3.2 is in progress for the integral test.

<u>Japan</u>

(cont'd)

Computer file of evaluated data : JENDL-3.2 (ENDF-6 Format).

Expected completion date : April of 1994.
Integral test will follow.

References:

(1) T. Watanabe, M. Kawai, S. Iijima, H. Matsunobu, T. Nakagawa, Y. Nakajima, T. Sigi, M. Sasaki and A. Zukeran: "JENDL-3 FP Data Library," JAERI-M 90-025, p.53 (1990).
(2) 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).
(3) T. Nakagawa: "Curves and Tables of Neutron Cross Sections of Fission Product Nuclei in JENDL-3," JAERI-M 92-077 (1992).
(4) T. Watanabe, M. Kawai, A. Zukeran, H. Matsunobu, T. Nakagawa, Y. Nakajima, T. Sugi, S. Chiba and M. Sasaki: "Integral Test of JENDL-3 FP Nuclear Data Library," Proc. Specialists' Meeting on Fission Product Nuclear Data, Tokai, May 1992, NEA/NSC/Doc(92)9, p.411 (1992).
(5) M. Kawai and JNDC Fission Product Nuclear Data Working Group: "Reevaluation of FP Nuclear Data for JENDL-3.2," JAERI-M 94-019, p.276 (1994).

SWEDEN

Laboratory and address:	University of Uppsala, The Studsvik Neutron Research Laboratory, S-61182 NYKÖPING, Sweden.
Name:	G. Rudstam
Evaluation:	Delayed Neutron Branching Ratios.
Purpose:	To provide evaluated P_n-values for the JEF-2 file.
Method and source of information:	Data on delayed neutron branching ratios published or given as private communication, and results from the Studsvik experiment (see contribution on experimental P_n-values in this issue) are included. Weighted averages were taken.
Discrepancies:	Discrepancies among measured P_n-values are discussed in the publication.
Publication:	G. Rudstam, K. Aleklett, and L. Sihver, Atomic Data and Nuclear Data Tables 53(1993)1.

SWEDEN

Laboratory and address:	University of Uppsala, The Studsvik Neutron Research Laboratory, S-61182 NYKÖPING, Sweden.
Name	G. Rudstam
Evaluation:	Isomeric yields in fission.
Purpose:	To improve the method to estimate isomeric yields in fission
Method and source of information:	A formula is developed containing two parameters, one defining the spin distribution of the fission fragments after the evaporation of neutrons and the other coupled to the spin distribution of the nuclear levels. Published experimental independent yields in thermal fission of ^{235}U are used to establish values of these parameters.
Completion date:	The work is finished.
Publication	G. Rudstam, Proceedings of a Specialists' Meeting on Fission Product Nuclear Data, Tokai, Japan, 25th–27th May 1992, NEA/NSC, DOC (92) 9 p. 271.

Evaluation:	Absolute gamma branching ratios for fission products in the mass range 74–165.
Purpose:	To list experimental determinations of absolute branching ratios of gamma-rays emitted from fission products. These quantities are required in all cases when the number of atoms of a nuclide in a sample is to be determined by gamma spectroscopy.
Source of information:	A literature search has been carried out covering publications before the middle of 1993.
Completion date:	The work is finished.
Publication:	G. Rudstam, report INDC(SWD)-024, 1993. *)

*) Note: there is a typing error on page 13 (Mass 88): the half-life of ^{88}Se should be: 1.53(6) seconds (not 61.53).

TAIWAN

Laboratory and address:	Institute of Nuclear Science National Tsing Hua University Hsinchu 30043, TAIWAN R.O.C.
Names:	Prof. Dr. Chien CHUNG
EVALUATION:	IFY in $^{239}Pu(n_{th},f)$
Method:	Least-square fit of Gaussian distribution of all data
Major sources of information:	published data available from literatures
Deadline of literature coverage:	1988.01
Status:	Completed
Cooperation:	None
Other relevant details:	None
Computer file of compiled data:	IBM PC disk
Computer file of evaluated data:	IBM PC disk
Availability:	on request
Discrepancies encountered:	large for IFY far from stability line
Completion data:	1989.08
Publications:	J. Radioanal. Nucl. Chem. 142 (1990) 253
Contact:	Prof. Dr. Chien Chung Institute of Nuclear Science National Tsing Hua University Hsinchu 30043, TAIWAN R.O.C.

UNITED KINGDOM

LABORATORY AEA Technology, Harwell, Oxfordshire OX11 0RA, UK

CONTACT NAME A L Nichols

EVALUATION Evaluation of decay data for reactor applications

Evaluation of decay data for following nuclides during 1993/94:
^{83m}Kr, ^{83}Rb, ^{84}Rb, ^{84m}Rb, ^{83}Sr, ^{83m}Sr, ^{105}Ag, ^{106}Ag, ^{106m}Ag, ^{119}Sb, ^{120}Sb, ^{120m}Sb, ^{129}Cs, ^{140}Nd, ^{143}Pm, ^{144}Pm, ^{148}Pm, ^{148m}Pm, ^{151}Pm, ^{151}Sm, ^{149}Eu, ^{151}Gd, ^{175}Yb, ^{171}Lu, ^{171m}Lu, ^{172}Lu, ^{172m}Lu, ^{173}Lu, ^{174}Lu, ^{174m}Lu, ^{177}Lu, ^{177m}Lu, ^{177}Ta, ^{178}W, ^{201}Tl, ^{202}Pb, ^{202m}Pb, ^{66}Ni, ^{105m}Rh, ^{107m}Pd, ^{53}Mn, ^{60}Fe, ^{60m}Co, ^{67}Cu;
during 1994/95:
^{115m}Cd, ^{131}Ba, ^{131m}Ba, ^{150}Eu, ^{150m}Eu, ^{150}Gd, ^{173}Hf, ^{183}Ta, ^{202}Tl, ^{203}Pb, ^{203m}Pb, ^{203n}Pb, ^{81}Kr, ^{85}Kr, ^{85m}Kr, ^{86}Rb, ^{86m}Rb, ^{91}Y, ^{91m}Y, ^{88}Zr, ^{91}Nb, ^{91m}Nb, ^{92}Nb, ^{92m}Nb, ^{105}Rh, ^{107}Pd, ^{111}Ag, ^{111m}Ag, ^{115}Cd, ^{133}Xe, ^{133m}Xe, ^{131}Cs, ^{146}Pm, ^{149}Pm, ^{153}Sm, ^{156}Eu, ^{153}Gd, ^{81m}Kr, ^{90}Sr, ^{103}Pd, ^{132}Cs, ^{147}Nd, ^{147}Pm, ^{205}Pb.

Original references assessed and resulting data evaluated; references identified via Nuclear Data Sheets and ENDF/B-VI files (August 1993).

Data being evaluated for UK Fission Product Decay Data files

STATUS In preparation - completion estimated by mid-1995

PUBLICATIONS A L Nichols, *Evaluation of Decay Data in the 4n Series*, AEA-TRS-5000, 1990;
A L Nichols, *Heavy Element and Actinide Decay Data: UKHEDD-2 Data Files*, AEA-RS-5219, 1991;
A L Nichols, *Activation Product Decay Data: UKPADD-2 Data Files*, AEA-RS-5449, 1993.

ADDRESS AEA Technology, EPED, 404 Harwell, Didcot, Oxfordshire OX11 0RA, UK (tel 0235 43 4113, fax 0235 43 6285).

UNITED KINGDOM

Laboratory and Address:	British Nuclear Fuels plc., Sellafield Works, Seascale, Cumbria, CA27 0EF.
Names:	M.F. James, Consultant to British Nuclear Fuels plc. R.W. Mills, British Nuclear Fuels plc. D.R. Weaver, The University of Birmingham.
Compilation & Evaluation:	Fission product yields for spontaneous and neutron induced fission for UKFY3 evaluation.
Purpose:	To compile experimental fission product yield data, and evaluate this data to produce a set of libraries in ENDF/B-VI format.
Method:	Weighted averaging of experimental data, fitting data to various models for chain and fractional independent yields, adjustment for physical constraints, isomeric splitting (from experimental data or Madland and England model) and the production of ENDF/B-VI formatted libraries.
Fissile materials considered:	Database contains spontaneous and induced fission yield data for all published nuclides. Study using the FISPIN code has shown the following nuclides to be significant for a wide range of nuclear fuel types and therefore will be included in UKFY3: Th: 232FH. U: 233TFH, 234F, 235TFH, 236F, 238FH. Np: 237TF, 238TF. Pu: 238TF, 239TF, 240F, 241TF, 242F. Am: 241TF, 242mTF, 243TF. Cm: 242S, 243TF, 244TFS, 245TF. Cf: 252S. (T=thermal, F=fast, H=high (14MeV), S=spontaneous)
Major Sources of data:	Source include compilations from: Crouch(1), England and Rider (2), James (3,4,5,6), EXFOR and searches of the open literature.
Status:	UKFY3 is planned for completion before December 1994.
Compilation:	Details of data, methods and discrepancies will be published by early 1995.
Evaluated files:	UKFY2 was completed and accepted for inclusion in JEF2.2. This is available from the NEA Data Bank. This evaluation is described in reference 3, 4, 5 and 6.
Contacts:	*R.W. Mills*, B548/21H, BNFL Sellafield, Seascale, Cumbria, CA20 1PG. United Kingdom. Telephone +44(9467)74682, Fax +44(9467)76579.

UNITED KINGDOM (cont'd)

Contacts (cont'd):

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D.R. Weaver, School of Physics and Space Research, The University of Birmingham, Edgbaston, Birmingham, B15 2TT, United Kingdom. Telephone +44(21)4144660.

References:

1) E.A. Crouch, "Fission product yields from neutron induced fission.", Atomic and Nuclear Data Sheets Vol. 19, No. 5, May 1977.

2) T.R. England and B.F. Rider, private communication, May 1989.

3) M.F. James, R.W. Mills and D.R. Weaver. Report AEA-TRS-1015. "A new evaluation of fission product yields and the production of a new library (UKFY2) of independent and Cumulative Yields. Part I. Methods and outline of evaluation.", January 1991.

4) M.F. James, R.W. Mills and D.R. Weaver, Report AEA-TRS-1018. "A new evaluation of fission product yields and the production of a new library (UKFY2) of independent and Cumulative Yields. Part II. Tables of measured and recommended fission yields.", January 1991.

5) M.F. James, R.W. Mills and D.R. Weaver. Report AEA-TRS-1019. "A new evaluation of fission product yields and the production of a new library (UKFY2) of independent and Cumulative Yields. Part III. Tables of fission yields with discrepant or sparse data.", January 1991.

6) M.F. James, R.W. Mills and D.R. Weaver. "A new evaluation of fission product yields and the production of a new library (UKFY2) of independent and cumulative yields", Progress in Nuclear Energy, Pergamon Press, Vol. 26, No. 1, pp. 1-29, 1991.

U.S.A.

Laboratory and address:	Argonne National Laboratory 9700 South Cass Avenue Argonne, Illinois 60439, U.S.A.
Author:	A. B. Smith
Evaluation:	Evaluated nuclear data files for the naturally-ocurring isotopes of cadmium, Argonne National Laboratory Report ANL/NDM-129 (1993).

USA

Laboratory and Address: Los Alamos National Laboratory, P. O. Box 1663
Los Alamos, New Mexico 87545 U.S.A

Names:
T.R. England (LANL)
W.B. Wilson (LANL)
J.-i. Katakura(JAERI)
B.F. Rider (LANL Consultant)
C.W. Reich (INEL)
R.E. Schenter(HEDL)
F. M. Mann(HEDL)
M. C. Brady(SNL)
J.M. Campbell(U. of Lowell)

Cooperation:

HEDL, INEL, BNL, IAEA, and ENDF/B sub-committees, plus other worldwide contributors.

Contact:

T. R. England or W. B. Wilson

LANL Internet Data:

Access to the LANL Internet Node for Nuclear Data is FTP to T2@LANL.GOV, using anonymous for name and and e-mail address for password.

Purpose:

To provide evaluations and compilations for ENDF/B and processed libraries based on ENDF/B and other files.

A. Decay Data

ENDF/B-VI decay data for 979 nuclides have been issued. Approximately 870 of these are in the fission product mass range and the rest are classed as either activation or actinide products. The file differs substantially from previous versions in that a) theory augments measured spectra where spectra are incomplete (115 cases), and is used for nuclides having no measurements (>200 nuclides); b)delayed neutron spectra are included for 270 precursors and six-group parameters are also included for 28 fissioning nuclides. Many comparisons with aggregate measurements are available in the references. In addition, we are expanding the library to include essentially all known radioactive nuclides (>2800) because of a need in various accelerator projects such as the transmutation of nuclear waste products. We are also working with the U. Of Lowell's ongoing measurements toward improvement of the short lived fission product data.

B. Yield Data

A second evaluation of 60 fission product yield sets using updated data and new distribution parameters plus information developed in the IAEA CRP has been completed and issued in ENDF/B-VI format. A draft of the evaluation report containing all measured and recommended evaluated data has been completed. Most of the text and some tables of this report will be issued as a full sized document, and all tabular data will also be available on the internet (above). This is a major document that includes a bibliography of 1575 references. The report (ENDF-349) is too large to issue all tables as a full sixed document, but all will be included in the anonymous internet node at LANL, BNL, and when such is available, IAEA.

Comment:

Readers should consult the previous issue of FPND for additional detail and some references prior to 1990 that are still of value.

Publications 1990-93:

1. M. C. Brady and T. R. England, " *Validation of Aggregate Delayed Neutron Spectra Calculated from Prrecursor Data,*" Proceedings of the Int'l Conf. on the Physics of Reactors: Design and Conputation, PHYSOR '90, April 23-26, 1990, Marseille, France

2. J. Katakura and T.R. England, " *Augmentation of ENDF/B FP Gamma-Ray Spectra by Calculated Spectra,*" Los Alamos National Laboratory Report LA-12125-MS ENDF-352, (October, 1991)

3. T. R. England, B. F. Rider, and M. C. Brady, " *Fission-Product Chain Yields and Delayed Neutrons: ANS 5.2 and ANS 5.8,*" Nov. 11-15, 1990 Trans. ANS Winter Meeting, Washington, D. C., V 62, p 529

4. R. E. Schenter, T. R. England, and J. Katakura, " *Status and Future for ANSI/ANS-5.1 Decay Heat Power in Light-Water Reactors,*" Nov. 11-15, 1990 Trans. ANS Winter Meeting, Washington, D. C., V 62, p 534 LA-UR-90-2518,

5. G. Rudstam and T. R. England, " *Test of Pre-ENDF-VI Decay and Fission Yields,*" Los Alamos report LA-11909-MS, (July, 1990)

6. C. W. Reich and T. R. England, " *The File of Evaluated Decay Data in ENDF/B,*" June 2-6, 1991, Orlando, Florida LA-UR-91-03 Trans. Am. Nucl. Soc., V63, p163

7. M. C. Brady, R. Q. Wright, and T. R. England, " *Actinide Nuclear Data for Reactor Physics Calculations,*" Oak Ridge National Laboratory report, ORNL/CSD/TM-266 (July,1991) LA-UR-91-352.

8. J. K. Dickens, T. R. England, and R. E. Schenter, " *Current Status and Proposed Improvements to the ANSI/ANS-5.1 American National Standard for Decay Heat Power in Light Water Reactors,*" Nuclear Safety, V33, No. 2, April-June,1991 (pp 209-221)

9. C. D. Bowman, et al, "*Nuclear Energy Without Long-Term High-Level Waste,*" Trans. Am. Nucl. Soc. 63, 80 (1991).

10. W. B. Wilson, et al, "*Transmutation Calculations for the Accelerator Transmutation of Waste,*" Trans. Am. Nucl. Soc. 63, 90 (1991).

11. W. B. Wilson, et al,"*Calculation of the Production and Decay of Radionuclides in the Hadron Calorimeter of the L* Detector for the SSC,*" Los Alamos National Laboratory informal report LA-UR 91-999 (March 4,1991).

12. C. D. Bowman, et al, "*Nuclear Energy Generation and Waste Transmutation Using an Accelerator-Driven Intense Thermal Neutron Source,*" Nuclear Instruments and Methods in Physics Research A320, 336-367 (1992),

13. T. R. England and B. F. Rider, "*ENDF/B Yield Evaluation for 1992: Methods and Content,*" Proceedings of the Specialists' Meeting on Fission Product Nuclear Data, May 25-27, 1992, JAERI, Tokai, Japan; Organization for Economic Co-Operation and Development Nuclear Energy Agency report NEA/NSC/DOC(92)9, pp. 346 - 357.

14. T. R. England and B. F. Rider, "*Yield Validation: Integral Comparisons,*" Proceedings of Specialists' Meeting on Fission Product Nuclear Data, May 25-27, 1992, JAERI, Tokai, Japan; Organization for Economic Co-Operation and Development Nuclear Energy Agency report NEA/NSC/DOC(92)9, pp. 378 - 391.

15. T. R. England, W. B. Wilson and A. J. Martinez, "*Radiation Protection Data to be Used in Assessing the Relative Ionization Toxicity of Calculated Mixtures of Radionuclides,*" Los Alamos National Laboratory informal document LA-UR 92-392 (January 23, 1992).

16. W. B. Wilson, et al, "*L* and GEM Calorimeter Transmutation Studies and Applicability to SDC,*" Proc. SDC Collaboration Meeting at KEK, May 26-29, 1992. Solenoid Detector Collaboration report SDC-92-276 (June 1992), pp. 1578-1601.

17. W. B. Wilson, T. R. England and D. C. George "*Sensitivity of Fission-Product Neutron Absorption to ENDF/B-IV, -V, and -VI Nuclear Data Parameters,*" Proceedings of the Specialists' Meeting on Fission Product Nuclear Data, May 25-27, 1992, JAERI, Tokai, Japan; Organization for Economic Co-Operation and Development Nuclear Energy Agency report NEA/NSC/DOC(92)9, pp. 450 - 457.

18. W. B. Wilson and T. R. England, "*Nuclear Data Needs for Studies of Accelerator Induced Neutron Transmutation of Nuclear Waste,*" Proceedings of the Specialists' Meeting on Fission Product Nuclear Data, May 25-27, 1992, JAERI, Tokai, Japan; Organization for Economic Co-Operation and Development Nuclear Energy Agency report NEA/NSC/DOC(92)9, pp. 475 - 481.

U.S.A. (cont'd)

19. R. E. Schenter and W. B. Wilson, "*Fission Product Data Requirements for Medical Applications,*" Proceedings of the Specialists' Meeting on Fission Product Nuclear Data, May 25–27, 1992, JAERI, Tokai, Japan; Organization for Economic Co-Operation and Development Nuclear Energy Agency report NEA/NSC/DOC(92)9, pp. 482 - 494.

20. T. R. England, et al, "*Decay Data Evaluation for ENDF/B-VI,*" C. L. Dunford, Ed., *Proceedings International Symposium on Nuclear Data Evaluation Methodology, October 12–16, 1992, Brookhaven National Laboratory. Upton, New York,* World Scientific, New Jersey.

21. W. B. Wilson and T. R. England, "*Development and Status of Fission–Product Yield Data and Applications to Calculations of Decay Properties,*" Trans. Am. Nucl. Soc. 66, 152 (1992).

22. W. B. Wilson, et al, "*Accelerator Transmutation Studies at Los Alamos with LAHET, MCNP, and CINDER'90,*" presented at the Workshop on Simulation of Accelerator Radiation Environments, January 11–15, 1993, Santa Fe, New Mexico. Los Alamos National Laboratory informal document LA-UR-93-3080.

23. W. B. Wilson, T. R. England and A. Gavron, "*Preliminary Calculations of Radionuclide Inventories and Aggregate Decay Properties of Sample Coupons in a Tungsten Target to be Irradiated at WNR,*" Los Alamos National Laboratory informal report T-2–IR–93–1 (January 4, 1993).

24. A. P. T. Palounek, et al, "*Calculation of Neutron Backgrounds and the Production and Decay of Radionuclides in the SDC Detector,*" Solenoidal Detector Collaboration Note SDC–93–467 (March 1993).

25. P. G. Young and W. B. Wilson, "*Nuclear Data Requirements for Transmutation,*" presented at the American Chemical Society Division of Nuclear Chemistry and Technology Meeting, Denver, Colorado, March 29, 1993. Los Alamos National Laboratory preprints LA–UR–994 and –1132.

26. T. O. Brun, et al, "*LAHET Code System/CINDER'90 Validation Calculations and Comparison With Experimental Data,*" Proceedings of the Twelfth Meeting of the International Collaboration on Advanced Neutron Sources, 24–28 May, 1993, The Cosener's House, Abingdon, Oxfordshire, U. K.

27. M. Diwan, et al, "*Radiation Environment and Shielding for the GEM Experiment at the SSC,*" Superconducting Super Collider Laboratory report SSCL–SR–1223 (July 1993).

28. D. W. Muir and W. B. Wilson, "*Validation of a Large Activation Cross-Section Library,*" to be presented at the International Conference on Nuclear Data for Science and Technology, May 9-13, 1994, Gatlinburg, Tenn.

29. G. P. Couchell, et al., "*Study of Gamma-Ray and Beta-Particle Decay Heat following Thermal Neutron Induced Fission of U-235,*"International Conference on Nuclear Data for Science and Technology, Gatlinburgh, Tennessee USA, 9-13 May, 1994

<u>U.S.A.</u> (cont'd)

30. W. A. Schier, et. al., *"Energy Distributions of Gamma and Beta Decay Heat as Function of Decay Time for U-238(n,f),"* International Conference on Nuclear Data for Science and Technology, Gatlinburgh, Tennessee USA, 9-13 May, 1994

31. D. J. Pullen, et. al., *"High-Resolution Gamma-Ray Spectra for U-235(n,ff),"* International Conference on Nuclear Data for Science and Technology, Gatlinburgh, Tennessee USA, 9-13 May, 1994

32. T. R. England and B. F. Rider, " *Evaluation and compilation of Fission Product Yields, 1993,*" ENDF-349 (Draft to be published as a Los Alamos laboratory report—this will be the primary documentation for ENDF/B-VI and the complete report will be available on internet 10-94.)

U.S.A.

Laboratory and address	Los Alamos National Laboratory, Group CST-13, MS-J514, Los Alamos, NM 87545, U.S.A.
Name	A. C. Wahl
Compilation and evaluation	Independent yields and other data related to nuclear-charge distribution in fission are compiled and evaluated for low-energy fission reactions (excitation energies up to $\sim$ 20 MeV). The current compilation includes data for thermal-neutron-induced fission of ^{229}Th, ^{233}U, ^{235}U, ^{238}Np, ^{239}Pu, ^{241}Pu, and ^{249}Cf, for spontaneous fission of ^{252}Cf, for fission-spectrum-neutron-induced fission of ^{238}U and ^{232}Th, and for 14-MeV-neutron-induced fission of ^{238}U. Yields for other fission reactions will be added as data become available.
Purpose	Systematic trends in independent yields (IN) are derived from the data by use of empirical models, which allow estimates to be made of independent yields for all fission products and contribute to the understanding of fission-reaction mechanisms.
Sources of information	Journals, reports, preprints, other compilations, and personal communcations.
Method	Original values of experimental data and uncertainties are maintained in files, and average values are calculated and normalized for each A, when sufficient data exist, so that the sum of fractional independent yields (FI) is unity. The set of FI values for each fission reaction, or IN values derived from them, are treated by the method of least squares to derive systematic trends in the yields described

by the Z_P and A'_P empirical models. Also, the dependencies of parameters for these models on mass, charge, excitation energy, etc. of fissioning nuclides are investigated, as described in references 1 and 2.

Cooperation Information can be exchanged with other groups.

Computer files Information is held in computer files.

Completions Compilation is continuous; evaluations and redetermination of parameters for models occurs periodically. Recent reports of data, evaluations, and model-estimated yields and uncertainties are given in references 1, 2, and 3.

Publications

1. A. C. Wahl," Systematic Trends in Fission Yields", in Proceedings of a Specialists' Meeting on Fission Product Nuclear Data, Japan Atomic Energy Research Institute, Tokai-Mura, Ibaraka-Ken, Japan, May 25–27, 1992, pp. 334–351; Los Alamos National Laboratory Report No. LA-UR-92-1425 also contains tables of parameter values for empirical models in 3 pages of Appendices.

2. A. C. Wahl, "Nuclear-Charge and Mass Distribution from Fission" in *50 Years with Nuclear Fission*, James W. Behrens and Allan D. Carlson editors, American Nuclear Society, La Grange Park, Illinois (1989), Vol. 2, pp. 525–532; presented at the Conference on 50 Years with Nuclear Fission, Washington D. C., April 25–28, 1989.

3. A. C. Wahl, "Nuclear-Charge Distribution and Delayed-neutron Yields for Thermal-neutron-induced Fission of ^{235}U, ^{233}U, and ^{239}Pu and for Spontaneous Fission of ^{252}Cf", *Atomic Data and Nuclear Data Tables* **39**, 1-156 (1988).

U.S.A. (cont'd)

4. A. C. Wahl, "Nuclear-Charge Distribution and Delayed-neutron Yields for Thermal-neutron-induced Fission of ^{235}U, ^{233}U, ^{239}Pu and ^{241}Pu and for Fast-neutron-induced Fission of ^{238}U", Proceedings of a Specialists' Meeting on Data for Decay Heat Predictions, held in Studsvik, Sweden, Sept., 1987. Reports NEACRP-302 'L', NEANOC-245 'U' (1987).

5. A. C. Wahl, "Nuclear-Charge Distribution Near Symmetry for Thermal-Neutron-Induced Fission of ^{235}U", *Phys. Rev. C* **32**, 184 (1985).

6. A. C. Wahl, "Nuclear Charge Distribution in Fission", in *New Directions in Physics, The Los Alamos 40th Anniversary Volume*, edited by N. Metropolis, D. Kerr, and G.-C. Rota, Academic Press, N.Y., 1987, pp. 163-189; presented at the Los Alamos 40th Annivesary Conference, April, 1983.

PART 2: RECENT PUBLICATIONS RELATED TO FPND

(Completeness of this section has not been attempted)

2.1 Publications not covered by contributions

The publications listed below refer to activities related to FPND which are not covered by the contributions contained in this issue. They are sorted according to:

2.1.1 Fission yields and charge distribution

2.1.2 Neutron reaction cross sections

2.1.3 Decay data

2.1.4 Delayed neutron data

2.1.5 FP decay heat

2.1.6 Reviews and summaries

For papers presented at meetings see section 2.2.

2.1.1 *Fission yields and charge distribution*

Excitation energy dependence of charge odd even effects in the fission of U-238 close to the fission barrier
S. Pomme, E. Jacobs, K. Persyn, D. De Frenne, K. Govaert, M.L. Yoneama
Nucl. Phys. **A560** (1993) 689

Measurement of cold fission for Th-229 (n_{th},f), U-232 (n_{th},f) and Pu-239 (n_{th},f) with the Cosi-Fan-Tutte spectrometer
M. Asghar, N. Boucheneb, G. Medkour, P. Geltenbort, B. Leroux
Nucl. Phys. **A560** (1993) 677

Isomeric yields of ^{130}Sb, ^{132}Sb, ^{134}I, and ^{136}I in the thermal neutron fission of ^{235}U
H.N. Erten
J. Radioanal. Nucl. Chem., Letters, **166** (1992) 187

Energies of long-range particles in ternary fission of the ^{238}U spontaneously fissioning isomer
I.A. Kukushkin, V.E. Makarenko, Yu.D. Molchanov, G.A. Otroshchenko, G.B. Yan'kov
Yad. Fiz. **54** (1991) 8 (Engl.: Sov. J. Nucl. Phys. **54** (1991) 4)

Mass distribution in the 14.7 MeV neutron-induced fission of ^{237}Np
Sun Tongyu, Li Wenxin, Fu Ming, Zhao Lili
J. Nucl. Radiochem. **13** (1991) 54

Mass and nuclear charge yields for $^{237}Np(2n_{th},f)$ at different fission fragment kinetic energies
G. Martinez, G. Barreau, A. Sicre, T.P. Doan, P. Audouard, B. Leroux, W. Arafa, R. Brissot, J.P. Bocquet, H. Faust, P. Koczon, M. Mutterer, F. Gönnenwein, M. Asghar, U. Quade, K. Rudolph, D. Engelhardt, E. Piasecki
Nucl. Phys. **A515** (1990) 433

Cumulative yields of ^{127g}Sn and ^{128}Sn in the spontaneous fission of ^{252}Cf
Zhao Xin, Li Xueliang, Guo Jingru, Wang Fangding, Tang Peijia, Liu Daming, Cui Anzhi, Su Shuxin
J. Radioanal. Nucl. Chem., Articles, **170** (1993) 99

Light charged particle release in fission: tripartition versus fragment de-excitation
A. Schubert, K. Möller, W. Neubert, W. Pilz, G. Schmidt, M. Adler, H. Märten
Z. Phys. A **338** (1991) 115
(spontaneous fission of 252-Cf)

Spontaneous fission properties of 2.9-s ^{256}No
D.C. Hoffman, D.M. Lee, K.E. Gregorich, M.J. Nurmia, R.B. Chadwick, K.B. Chen, K.R. Czerwinski, C.M. Gannett, H.L. Hall, R.A. Henderson, B. Kadkhodayan, S.A. Kreek, J.D. Leyba
Phys. Rev. C **41** (1990) 631

Spontaneous emission of light fragments (decay/fission)

High-statistics study of cluster radioactivity from ^{233}U
P.B. Price, K.J. Moody, E.K. Hulet, R. Bonetti, C. Migliorino
Phys. Rev. C **43** (1991) 1781

2.1.2 *Neutron reaction cross sections*

Recent advances in the k_0-standardization of neutron activation analysis: extensions, applications, prospects
F. de Corte, A. Simonits, F. Bellemans, M.C. Freitas, S. Jovanović, B. Smodiš, G. Erdtmann, H. Petri, A. de Wispelaere
J. Radioanal. Nucl. Chem., Articles, **169** (1993) 125
(k_0 factors, including many fission products)

Determination of k_0- and Q_0-factors of short-lived nuclides
S. Roth, F. Grass, F. de Corte, L. Moens, K. Buchtela
J. Radioanal. Nucl. Chem., Articles, **169** (1993) 159
(incl.: Ga-69, Ge-74,76, Rb-85, Pd-106,8, In-115, Er-166)

Complete spectroscopy of ^{90}Y via the $^{89}Y(n,\gamma)$ and $^{89}Y(d,p)$ reactions
S. Michaelsen, A. Harder, K.P. Lieb, G. Graw, R. Hertenberger, D. Hofer, P. Schiemenz, E. Zanotti, H. Lenske, A. Weigel, H.H. Wolter, S.J. Robinson, A.P. Williams
Nucl. Phys. **A552** (1993) 232

Burnup of long-lived radiactive fission products ^{90}Sr and ^{137}Cs in a fast-neutron flux
V.V. Artisyuk, A.Yu. Konobeev, Yu.A. Korovin, V.N. Sosnin
At. En. **71** (1991) 184 (Engl.: Sov. At. En. **71** (1992) 704)

Measurement of the $^{93}Nb(n,n')^{93m}Nb$ reaction cross section at 14.5 and 14.9 MeV
Y. Ikeda, C. Konno, K. Kosako, M. Asai, K. Kawade, H. Maekawa
J. Nucl. Sci. Tech. **30** (1993) 967

Measurement of the activation cross section for the reaction $^{93}Nb(n,n')^{93m}Nb$ in the neutron energy range 6-9 MeV
M. Wagner, H. Vonach, R.C. Haight
Ann. Nucl. Energy **20** (1993) 1

Cross sections for the $^{93}Nb(n,2n)^{92m}Nb$ reaction
D.C. Santry, R.D. Werner
Can. J. Phys. **68** (1990) 582

Measurements of keV neutron capture cross sections with a 4π barium fluoride detector: Examples of ^{93}Nb, ^{103}Rh, and ^{181}Ta
K. Wisshak, F. Voss, F. Käppeler
Phys. Rev. C **42** (1990) 1731

Refining fission-product capture cross sections in reactivity-perturbation experiments
S.M. Bednyakov, G.N. Manturov
At. En. **72** (1992) 95 (Engl.: Sov. At. En. **72** (1992) 91)
(incl.: Mo-95,97,98,100, Rh-103, Pd-105, Ag-109, Pr-141, Nd-143,5, Sm-149, Eu-153)

Level and decay scheme of ^{103}Rh by means of the $(n,n'$-$\gamma)$ reaction
U. Abbondanno, F. Demanins, F. Raicich
Nuovo Cimento **104** A (1991) 277

Measurement of radiative capture of fast neutrons in ^{55}Mn and ^{115}In
R.P. Gautam, R.K.Y. Singh, I.A. Rizvi, M. Afzal Ansari, A.K. Chaubey
Indian J. Pure Applied Phys. **28** (1990) 235

Neutron induced reaction cross-section of ^{115}In around 14 MeV
J. Csikai, Zs. Lantos, Cs.M. Buczkó, S. Sudár
Z. Phys. A **337** (1990) 39

A study of the $^{125}Te(n,\gamma)^{126}Te$ reaction with thermal neutrons
J. Honzátko, K. Konečný, I. Tomandl
Czech. J. Phys. **44** (1994) 11

Thermal-neutron-capture studies on ^{135}Ba
V.A. Bondarenko, I.L. Kuvaga, P.T. Prokofjev, V.A. Khitrov, Yu.V. Kholnov, Le Hong Khiem, Yu.P. Popov, A.M. Sukhovoj, S. Brant, V. Paar, V. Lopac
Nucl. Phys. **A551** (1993) 54

Energy levels and γ-decay scheme of ^{141}Pr via the (n,n'γ) reaction
F. Demainis, F. Raicich
Nuovo Cimento **105 A** (1992) 449

Activation cross sections and isomeric ratios in reactions induced by 14.5 MeV neutrons on ^{152}Sm, ^{154}Sm and ^{178}Hf
A. Kirov, N. Nenoff, E. Georgieva, C. Necheva, I. Ephtimov
Z. Phys. A **345** (1993) 285

Energy dependence of the isomeric ratio of ^{151}Eu
V.A. Pshenichnyi, E.A. Gritsai
Yad. Fiz. **51** (1990) 621 (Engl.: Sov. J. Nucl. Phys. **51** (1990) 393)

Measurement of the isomeric ratios for nuclei with $A > 150$
V.I. Gavrilyuk, V.A. Zheltonozhskii, S.V. Reshit'ko, V.B. Kharlanov
Izv. Akad. Nauk SSSR. Ser. Fiz. **54** (1990) 1006 (Engl.: Bull. Acad. Sci. USSR **54**, no. 5 (1990) 190)
(incl.: Eu-151 (n,γ) Eu-152m1,m2,g)

2.1.3 *Decay data*

Beta-decay half-lives of neutron rich Cu and Ni isotopes produced by thermal fission of ^{235}U and ^{239}Pu
M. Bernas, P. Armbruster, J.P. Bocquet, R. Brissot, H. Faust, Ch. Kozhuharov, J.L. Sida
Z. Phys. A **336** (1990) 41
(incl.: Cu-74,5, Ni-71,2,3,4)

Structure of ^{76}Zn from ^{76}Cu decay and systematics of neutron-rich Zn nuclei
J.A. Winger, J.C. Hill, F.K. Wohn, E.K. Warburton, R.L. Gill, A. Piotrowski, R.B. Schuhmann, D.S. Brenner
Phys. Rev. C **42** (1990) 954

Level lifetime measurements and the structure of neutron-rich ^{78}Ge
W.-T. Chou, D.S. Brenner, R.F. Casten, R.L. Gill
Phys. Rev. C **47** (1993) 157

New and revised half-life measurements results
M.P. Unterweger, D.D. Hoppes, F.J. Schima
Nucl. Instr. Meth. Phys. Res. **A312** (1992) 349
(incl.: Kr-85, Sb-125, Cs-137, Eu-152,4,5)

Retardation of $B(E2;0_1^+ \rightarrow 2_1^+)$ rates in $^{90-96}Sr$ and strong subshell closure effects in the $A \sim 100$ region
H. Mach, F.K. Wohn, G. Molnár, K. Sistemich, C. Hill, M. Moszyński, R.L. Gill, W. Krips, D.S. Brenner
Nucl. Phys. **A523** (1991) 197

Meson-exchange enhancement of the first-forbidden $^{96}Y^g(0^-)\rightarrow^{96}Zr^g(0^+)\beta$ transition: β decay of the low-spin isomer of ^{96}Y

H. Mach, E.K. Warburton, R.L. Gill, R.F. Casten, J.A. Becker, B.A. Brown, J.A. Winger
Phys. Rev. C **41** (1990) 226

Deformation and shape coexistence of 0^+ states in ^{98}Sr and ^{100}Zr

H. Mach, M. Moszyński, R.L. Gill, F.K. Wohn, J.A. Winger, J.C. Hill, G. Molnár, K. Sistemich
Phys. Lett. B **230** (1989) 21

Rotational bands in the mass 100 region

M.A.C. Hotchkis, J.L. Durell, J.B. Fitzgerald, A.S. Mowbray, W.R. Phillips, I. Ahmad, M.P. Carpenter, R.V.F. Janssens, T.L. Khoo, E.F. Moore, Ph. Benet, D. Ye
Nucl. Phys. **A530** (1991) 111
(prompt γ-transitions from fission in: Sr-98,99,100, Y-99,101, Zr-100,1,2,3,4, Nb-101,3,5, Mo-102,3,4,5,6,7,8)

Study of ^{99}Mo and ^{111}Ag decays

J. Goswamy, B. Chand, D. Mehta, Nirmal Singh, P.N. Trehan
Appl. Radiat. Isot. **43** (1992) 1467

New neutron-rich nuclei $^{103,104}Zr$ and the $A\sim100$ region of deformation

M.A.C. Hotchkis, J.L. Durell, J.B. Fitzgerald, A.S. Mowbray, W.R. Phillips, I. Ahmad, M.P. Carpenter, R.V.F. Janssens, T.L. Khoo, E.F. Moore, L.R. Morss, Ph. Benet, D. Ye
Phys. Rev. Lett. **64** (1990) 3123

Search for double β-decay of ^{100}Mo and ^{116}Cd to the excited states of ^{100}Ru and ^{116}Sn

A.S. Barabash, A.V. Kopylov, V.I. Cherehovsky
Phys. Lett. B **249** (1990) 186

Structure of highly deformed ^{102}Zr populated in decay of low- and high-spin isomers of ^{102}Y

J.C. Hill, D.D. Schwellenbach, F.K. Wohn, J.A. Winger, R.L. Gill, H. Ohm, K. Sistemich
Phys. Rev. C **43** (1991) 2591

Discovery of rare neutron-rich Zr, Nb, Mo, Tc, and Ru isotopes in fission: test of β half-life predictions very far from stability

J. Äystö, A. Astier, T. Enqvist, K. Eskola, Z. Janas, A. Jokinen, K.-L. Kratz, M. Leino, H. Penttilä, B. Pfeiffer, J. Zylicz
Phys. Rev. Lett **69** (1992) 1167
(incl.: Zr-105, Nb-107, Mo-109,110, Tc-113, Ru-115)

Precise measurement of gamma ray energies with HPGE spectrometer by slithering comparison method

Zhang Tianbao, Wang Shuying, Wang Haidong, Shen Zhiqi, Meng Bonian
High En. Phys. Nucl. Phys. **17** (1993) 202
(incl.: Ru-106)

Collective structure of the neutron-rich nuclei, ^{110}Ru and ^{112}Ru

J. Äystö, P.P. Jauho, Z. Janas, A. Jokinen, J.M. Parmonen, H. Penttilä, P. Taskinen, R. Béraud, R. Duffait, A. Emsallem, J. Meyer, M. Meyer, N. Redon, M.E. Leino, K. Eskola, P. Dendooven
Nucl. Phys. **A515** (1990) 365

Spin-flip β-decay of even-even deformed nuclei ^{110}Ru and ^{112}Ru

A. Jokinen, J. Äystö, P. Dendooven, K. Eskola, Z. Janas, P.P. Jauho, M.E. Leino, J.M. Parmonen, H. Penttilä, K. Rykaczewski, P. Taskinen
Z. Phys. A **340** (1991) 21

First observation of the beta decay of ^{117}Pd and the discovery of a new isotope ^{119}Pd

H. Penttilä, J. Äystö, K. Eskola, Z. Janas, P.P. Jauho, A. Jokinen, M.E. Leino, J.M. Parmonen, P. Taskinen
Z. Phys. A **338** (1991) 291

Gamow-Teller decay of ^{118}Pd and of the new isotope ^{120}Pd

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2.2 Meetings

Specialists' Meeting on Fission Product Nuclear Data
Tokai, Japan, 25th - 27th May 1992

Proceedings: OECD/NEA report NEA/NSC/DOC(92)9

PART 3: REQUESTS FOR FISSION YIELD MEASUREMENTS

issued by the participants of the

IAEA Co-ordinated Research Programme
on the
Compilation and Evaluation of Fission Yield Nuclear Data

The complete tables of requested yield data were published as **Supplement to WRENDA 93/94, IAEA/NDS report INDC(SEC)-105, 1994**. The introduction and general requests are reproduced (with modifications) below, for the detailed tables of requested chain and independent yield measurements (over 20 pages) the reader is referred to INDC(SEC)-105.

THE IAEA CO-ORDINATED RESEARCH PROGRAMME (CRP)

The IAEA Co-ordinated Research Programme (CRP) on the Compilation and Evaluation of Fission Yield Nuclear Data has been established to enable and support the co-operation of scientists in the improvement of existing fission yield evaluations.

Many yield sets (60 in the US evaluation) have been requested by users. Altogether, there are still far more gaps (where no or only one measurement exists) than yields with sufficient measurements. Semiempirical models are used in evaluations for fitting and/or predicting yields. Furthermore, for the first time the dependence of yield data on the incident neutron energy will be part of the evaluations.

Consequently, many more measurements are needed. To improve the model parameters and for evaluating the energy dependence of yields, systematic studies of yields by experiment are required. More information on the requested data is given below. **Background information on the CRP** work and the requests issued can be found in a **review paper**:

M. Lammer, NEANSC Specialists' Meeting on Fission Product Nuclear Data, Tokai, Japan, 25-27 May 1992; Proceedings: NEA/NSC/DOC(92)9, page 68.

GENERAL REQUESTS FOR FISSION YIELD MEASUEREMENTS

General requests for fission yield measurements are issued for any fissioning system (= combination of fissioning nuclide and neutron energy) at various neutron energies and yield types. Also included are requests for systematic investigations of fission yields and related quantities by measurement. Such investigations from single experiments would yield more information on systematics than data from different experiments covering e.g. only one neutron energy or fissioning nuclide each, even though the latter may be of higher accuracy than the former.

3.1 Measurements for individual fissioning systems

Ternary fission yields:

Many new measurements of ternary yields, also versus binary fragment, should be conducted for all fissioning systems presented in INDC(SEC)-105.

Chain yields:

INDC(SEC)-105 presents tables of chain yields with data deficiencies. New accurate measurements for discrepant data and many more measurements of complete mass distributions where data are lacking should be performed.

Measurements should be made of yields in the wing and valley region of mass distributions, in particular for Th-227 thermal fisson.

Independent yields:

Independent yield measurements are important for the improvement of semiempirical models and the prediction of decay heat via summation calculations.

There are so many unmeasured independent yields that only cases of discrepancies are listed in the detailed tables in INDC(SEC)-105. Practically all fissioning systems need further measurements. Special care should be taken by measurers to take into account isomeric yields, branching fractions and delayed neutron emission in independent yield measurements.

Isomeric yield ratios:

Further measurements of isomeric yield ratios are needed to fill gaps and for the improvement and testing of models.

3.2 Studies of the energy dependence of yields

It is recommended to measure the energy dependence of yields with monoenergetic neutrons and spectra with varying spectral index.
Mono-energetic measurements should be performed of:

independent yields
ternary fission yields
isomeric yield ratios
chain yields

for neutron energies ranging from thermal to very high (above 20 MeV). Measurements of ternary fission yields are most important for applications.

3.3 Systematic studies for the improvement of model calculations

Direct measurements of the **energy dependence of the pairing effect** with a double ionization chamber should be conducted to confirm the observation, that the pairing effect drops with the excitation energy and with Z of the fissioning nucleus.

For the understanding of the **energy dissipation in fission** at the scission point it is desirable to measure simultaneously the kinetic energy, neutron emission and the emission angle versus (Z,A) of the fragments for different neutron energies.

Systematic trends of the **odd-even effect** as a function of (Z,A) of the fissioning nuclide and of the neutron energy should be studied in detail by measurement.

There are insufficient nuclear-charge-distribution data for most fast-neutron-induced fission reactions to determine **even-odd-Z factors** directly. Further measurements are needed.

Independent yield measurements for fragments **near symmetry** are needed for a number of fission reactions with different A, Z, and excitation energies, as the behaviour of semiempirical model parameters near symmetric fission (distribution width, charge displacement) is still uncertain.

More measurements of yields at the **wings** and in the **valleys** of mass distributions, are required for many fission reactions to allow a systematic study of Gaussian shapes to represent mass distributions.

The priorities for measurements are:
1st priority: independent yields
2nd priority: yields at wings and in valley

Fission reactions:
1st priority for U-235
2nd priority for other reactions.