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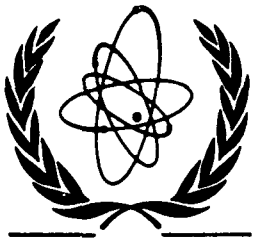

International Atomic Energy Agency

INDC INTERNATIONAL NUCLEAR DATA COMMITTEE

REPORT OF THE NUCLEAR DATA SECTION TO THE INTERNATIONAL NUCLEAR DATA COMMITTEE

SEPTEMBER 1975 TO FEBRUARY 1977

March 1977

IAEA NUCLEAR DATA SECTION, KÄRNTNER RING 11, A-1010 VIENNA

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List of Abbreviations

A+M	Atomic and molecular
CAJaD	Centre for Data on the Structure of the Atomic Nucleus and Nuclear Reactions of the USSR State Committee on the Utilization of Atomic Energy, located at the Kurchatov Institute in Moscow
CBNM	Central Bureau for Nuclear Measurements, located at Geel, Belgium
CCDN	Centre de Compilation de Données Neutroniques, same as NDCC Neutron Data Compilation Centre of the OECD Nuclear Energy Agency at Saclay near Paris
CINDA	Computerized Index of Neutron Data, a specialized bibliography and data index on neutron nuclear data operated jointly by NNCSC, NDCC, NDS and CJD
CINDU	A catalogue of numerical nuclear data libraries available from NDS
CJD	Centr po Jadernym Dannym, the USSR Nuclear Data Center at F.E.I. Obninsk
CODATA	Committee on Data for Science and Technology
CODEN	International code for the abbreviation of periodical titles used by ASTM, INIS and Chemical Abstracts
CPL	Computer Programme Library operated by NEA, and located at Ispra, Italy
CPND	Charged particle nuclear reaction data
CSISRS	NNCSC's internal system for handling experimental data; the previous system was known as SCISRS
DBMS	Data base management system
EBCDIC	Extended binary-coded decimal interchange code
ENDF/B	Evaluated Nuclear Data File of the United States
ENSDF	Computer-based Evaluated Nuclear Structure Data File developed by US/NDP

EXFOR	Exchange Format, initially developed for the international exchange of neutron nuclear data, now being extended to charged particle nuclear data
FPND	Fission product nuclear data
IAEA/NDS	Nuclear Data Section of the International Atomic Energy Agency, also NDS
ICTP	International Centre for Theoretical Physics
IFRC	International Fusion Research Council
INDC	International Nuclear Data Committee
INIS	International Nuclear Information System, a bibliographic system operated by the IAEA
IWGRRM	International Working Group on Reactor Radiation Measurements
KACHAPAG	Karlsruhe Charged Particle Group
KEDAK	Karlsruhe Evaluated Neutron Data File
LIYaF	Leningrad Institut Yadernoy Fiziki: Leningrad Nuclear Physics Institute of the USSR Academy of Sciences
NDCC	Neutron Data Compilation Centre (Centre de Compilation de Donnees Neutroniques - CCDN) of the OECD Nuclear Energy Agency at Saclay near Paris
NDP	Nuclear Data Project located at the Oak Ridge National Laboratory (also referred to as US/NDP)
NDS	IAEA Nuclear Data Section, Vienna
NEA	Nuclear Energy Agency of the OECD
NEANDC	Nuclear Data Committee of the Nuclear Energy Agency
NNCSC	US National Neutron Cross Section Center at the Brookhaven National Laboratory, Upton, N.Y.
NND	Neutron Nuclear Reaction Data
NSDD	NSD data = Nuclear Structure and Decay Data

OECD	Organization for Economic Cooperation and Development
SOKRATOR	Soviet Evaluated Neutron Data File Format
TND	Transactinium isotope nuclear data
UKNDL	UK Nuclear Data Library
WRENDA	World Request List for Nuclear Data Measurements published by the IAEA
ZAED	Zentralstelle fuer Atomkernenergie-Dokumentation: Nuclear documentation and information centre for the Federal Republic of Germany

INDC(SEC) Documents Published Since the Last INDC Meeting

INDC(SEC)-052/U	Jul 76	INDC Correspondents for the Exchange of Nuclear Data Information, June 1976 (Supersedes INDC(SEC)-47/U of June 1975)
INDC(SEC)-053/U	Jul 76	List of Documents Received by the INDC Secretariat, June 1976 (Supersedes INDC(SEC)-48/U and Supplement 1 thereto)
INDC(SEC)-054/L	Sep 76	IAEA Programme on Benchmark Neutron Fields Applications for Reactor Dosimetry M. Vlasov, July 1976
INDC(SEC)-055/U	Oct 76	WRENDA 76/77 - World Request List for Nuclear Data, August 1976
INDC(SEC)-056/U	Nov 76	INDC Correspondents for the Exchange of Nuclear Data Information, November 1976 (Supersedes INDC(SEC)-52/U)
INDC(SEC)-057/GA	Jan 77	Minutes of the First Meeting of the Joint IFRC/ /INDC Subcommittee on Atomic and Molecular Data for Fusion, Culham Laboratory, UK, 5 November 1976, A. Lorenz, January 1977
INDC(SEC)-058/LN	Jan 77	1976 Compilation of National Nuclear Data Committees, January 1977 (Supersedes INDC(SEC)-49/L)
INDC(SEC)-059/U	Apr 77	List of Documents Received by the INDC Secretariat March 1977 (Supersedes INDC(SEC)-53/U)
INDC(SEC)-060/U	Apr 77	INDC Correspondents for the Exchange of Nuclear Data Information, March 1977 (Supersedes INDC(SEC)-52/U)
INDC(SEC)-061/L	May 77	Consolidated Progress Report for 1976 on Nuclear Data Activities in the NDS Service Area
INDC(SEC)-062/L	May 77	Consolidated Progress Report for 1976 on Nuclear Data Activities Outside the NDS Service Area

INDC(NDS) Documents Published Since the Last INDC Meeting

INDC(NDS)-068/G	Sep 75	Report on the Eleventh Four-Centre Meeting 10-14 March 1975, Brookhaven National Lab., USA G. Thompson, N. Holden
INDC(NDS)-069/G	Mar 76	Consultants Meeting on Charged Particle Nuclear Data (CPND) Compilation, Vienna, 8-12 September 1975
INDC(NDS)-070/G	Dec 75	Progress in Fission Product Nuclear Data Information about Activities in the Field of Measurements and Compilations/Evaluations of Fission Product Nuclear Data (FPND) Edited by G. Lammer, November 1975, No. 1
INDC(NDS)-071/LN	Mar 76	Summary of the Consultants Meeting on Charged Particle Nuclear Data (CPND) Compilation Vienna, 8-12 September 1975 Edited by H. Lemmel (This Document is a Summary of INDC(NDS)-69)
INDC(NDS)-072/LN	Feb 76	Survey of Atomic and Molecular Data Needs for Fusion, January 1976 A. Lorenz, J. Phillips, J.J. Schmidt, J.R. Lemley (Also sent out on "A" distribution)
INDC(NDS)-073/L	Apr 76	Summary Report of the IAEA Consultants Meeting on the Use of Nuclear Theory in Neutron Nuclear Data Evaluation, Trieste, 8-11 December 1975 Edited by J.J. Schmidt, March 1976
INDC(NDS)-074/L	May 76	Summary Report of the IAEA Advisory Group Meeting on Transactinium Isotope Nuclear Data Karlsruhe, 3-7 November 1975 Edited by A. Lorenz, March 1976
INDC(NDS)-075/GP	Jun 76	Progress in Fission Product Nuclear Data - Information about Activities in the Field of Measurements and Compilations/Evaluations of Fission Product Nuclear Data (FPND) G. Lammer
INDC(NDS)-076/LN	Aug 76	The IAEA Nuclear Data Center - Its Role in the International Scientific Community A. Lorenz

INDC(NDS)-077/G	Dec 76	Report on the Second Consultants Meeting on Charged Particle Nuclear Data (CPND) Compilation Vienna, 28-30 April 1976 O. Schwerer
INDC(NDS)-078/G	Nov 76	Report on the Twelfth Four-Centre Meeting Vienna, 26-27 April 1976
INDC(NDS)-079/LN	Jan 77	Summary Report of the IAEA Advisory Group Meeting on Nuclear Structure and Decay Data for Applications, Vienna, 3-7 May 1976 Edited by A. Lorenz, December 1976
INDC(NDS)-080/LN	Sep 76	Compilations and Evaluations of Nuclear Structure and Decay Data, Issue No. 1 A. Lorenz, September 1976
INDC(NDS)-081/LM	Mar 77	Summary Report of the IAEA Consultants' Meeting on Integral Cross-Section Measurements in Standard Neutron Fields, Vienna, 15-19 November 76 Edited by M. Vlasov
INDC(NDS)-082/GB	Mar 77	Summary Report of the IAEA Advisory Group Meeting on Atomic and Molecular Data for Fusion Culham Laboratory, UK, 1-5 November 1976 Edited by A. Lorenz, February 1977
INDC(NDS)-083/LN	Mar 77	Compilations and Evaluations of Nuclear Structure and Decay Data, Issue No. 2 Compiled by A. Lorenz, March 1977
INDC(NDS)-084/L	Apr 77	Status of Neutron Cross Sections for Reactor Dosimetry M. Vlasov, A. Fabry, W.N. McElroy
INDC(NDS)-085/LNA	Apr 77	Report of the Nuclear Data Section to the International Nuclear Data Committee September 1975 to February 1977

INTRODUCTION

As a result of the agreement between INDC and NEANDC to extend the time interval between the individual committee meetings to eighteen months, this progress report on the activities of the IAEA Nuclear Data Section (NDS) covers the eighteen months period between September 1975 and February 1977.

During this period NDS had a relatively small turn-over of staff and was for most of the time fully staffed. J.R. Lemley who left NDS for the US in October 1975, was replaced by R.M. Lessler from the Lawrence Livermore Laboratory in the US in January 1976. In November 1975 R. Yaghubian from Iran replaced A. Calamand who returned to France, and O. Schwerer from the Institut for Radiumforschung und Kernphysik in Vienna was appointed to a new regular post in January 1977. M. Khalil left the Section in September 1976 to return to Iraq and was replaced in February 1977 by H. Marin-Guzman (programmer analyst) from Costa Rica. During 1976 Alex Lorenz's position as Deputy Head of NDS was established on a firm long-term basis. In January 1977 E. Rogauz was assigned the responsibility of secretary to the Section's new Atomic and Molecular (A+M) Data Unit, she was replaced by M.A. Donovan to serve as secretary of the Section's Programming Unit.

The staff complement of the Section's new A+M Data Unit as approved by the Agency's governing organs has been hired during the first quarter of 1977. Earl C. Beaty from the Information Center of the Joint Institute for Laboratory Astrophysics (JILA), Boulder, Colorado, US, will join NDS in May 1977 to head the Section's A+M data programme. In the execution of the programme he will be assisted by Konstantinos Katsonis (physicist) from Saloniki, Greece, and Robert Seamon (programmer analyst) from Los Alamos, US, who joined NDS in January and March 1977 respectively. A data preparation clerk will be hired to perform the necessary keypunching for the A+M Data Unit.

In the reporting period NDS experienced a strong increase in the number of requests received from customers in its service area. This is concurrent with the growing interest of developing countries in nuclear energy and techniques. Currently, an average of one request for data or documents is being received per working day. Also, as a result of the growing volume and increased sophistication of the data libraries received and held by NDS, the workload to satisfy a data request has increased.

Several steps are being taken by NDS to cope with this increased workload. NDS has requested a new professional physicist post (supported by INDC at its Eighth Meeting in October 1975) which, subject to budgetary approval by the Agency's governing organs, will be available to NDS from 1978 onwards.

The addition of this new post, advisory missions to Member States in the NDS service area conducted in 1976 to Poland and the German Democratic Republic and in 1977 to Hungary and Romania, as well as plans for temporary employments (costfree to the Agency) of scientists from developing countries from 1977 onwards, will hopefully meet the increasing requirements of countries "going nuclear" for improved physics advice on the use of nuclear data. Furthermore, the new (March 1976) "Catalogue of Numerical Nuclear Data available from IAEA/NDS", CINDU-11, has been given a wide distribution to countries in its service area. Most of the content of CINDU-11 is devoted to a detailed description of the content of the Section's data files and libraries and of the services provided by NDS. To help meet the demands of the concurrently increasing workload of the Section the programming team will, within the next two years, develop a fully integrated computerized system for effective data indexing, retrieval and book-keeping and much improved services to data users.

In the reporting period eleven meetings were sponsored by NDS, and two other meetings were co-sponsored with other organizations. The size of these meetings ranged from small consultants meetings and technical committees to larger advisory group meetings (previously called panels). Technically these meetings can be classified in two categories:

- Meetings of data centre representatives to discuss and coordinate data centre operations;

- Meetings of representatives of the nuclear community to assess requirements and status and coordinate required work in well-defined data or subject fields.

The first category comprizes meetings of representatives of data centres dealing with neutron, charged particle and photonuclear, nuclear structure and decay, and A+M data. The generalization of EXFOR to comprize all nuclear reaction data will allow, from 1977 onwards, the consolidation of the independent meetings on neutron and on charged particle and photonuclear reaction data into one meeting on nuclear reaction data. Following past practice, yearly meetings are planned to be held for each of the three data disciplines (nuclear reaction, nuclear structure and decay data and A+M data) in the scope of NDS.

Data subject fields covered in the second category of meetings were reactor dosimetry neutron data, transactinium isotope nuclear data and nuclear data for shielding. To this category belong also a meeting jointly organized with the Agency's INIS Section on the subject of the improvement of INIS retrievals for nuclear data references, and two Consultants Meetings jointly organized with the International Centre for Theoretical Physics, Trieste, on the subject of nuclear theory for applications.

In agreement with the recommendations of INDC, no conference on nuclear data is foreseen to be held by the IAEA in the foreseeable future. Instead cooperation or co-sponsorship of external nuclear data conferences is planned (1978 NEA/UKAEA Conference at Harwell, 1979 Conference in the US) particularly with a view to support participation of scientists from developing countries in such conferences. Emphasis will continue to be placed by IAEA/NDS on data centre and on data subject review meetings as explained above. The only undertaking in the near future which does not fall in this class of meetings is a four weeks Course on Nuclear Theory for Applications organized by NDS in cooperation with ICTP Trieste in the beginning of 1978 and scheduled to be held at the ICTP.

In the framework of the Section's coordinating activities, WRENDA, the World Request List for Nuclear Data, will be published only every two years from 1976 onwards. The first biennial edition, WRENDA 76/77, was issued in August 1976. It combines only partially updated requests for fission, fusion and safeguards nuclear data in one document and contains still more than 1600 requests from 19 Member States. Compared to the 1975 edition neither the number of the requests has changed nor the emphasis which continues to be focussed on standards, structural materials, fission products, and actinides (including the major fissile and fertile materials).

The targets and samples programme has been pursued by providing laboratories in four developing countries with sample materials for a number of measurements and applications most of which are related to WRENDA requests. Reports were received on the results of two experiments in Yugoslavia and Romania which had been supported by this programme; they are being published as INDC reports.

The review of measured differential neutron data for reactor dosimetry is currently being continued in close cooperation with the community concerned, and the role of integral measurements for the checking of the differential data being investigated as part of the IAEA/NDS Programme on Benchmark Neutron Fields Applications for Reactor Dosimetry. Another IAEA programme on the Standardization of Reactor Radiation Measurements which is maintained jointly by the Physics Section of the Agency's Seibersdorf Laboratory, the Division of Nuclear Power and Reactors, the Computer Section and NDS has the objective to provide standard operating procedures for reactor laboratories to measure reactor neutron fluence and spectra by the multiple foil activation technique. NDS continuously participated in this programme by reviewing, testing and evaluating selected important neutron reactions and preparing multigroup cross sections for use in the SAND-2 unfolding programme.

Two issues of the report series "Progress in Fission Product Nuclear Data" have been published by NDS and the third one is scheduled to be issued in May 1977. The purpose of this series is to inform scientists determining or using FPND about planned, ongoing and recently completed work in the field. Scientists from 24 laboratories in 12 countries contributed to the first issues, and the reports are given a wide distribution in the scientific community concerned.

In context of its function as central information office for nuclear structure and decay data, NDS has started the semi-annual publication of a list of published and to-be-published compilations and evaluations of nuclear structure and decay data; this list is given a wide distribution among users of such data.

For economic reasons a two years publication cycle of CINDA was introduced with the first biennial publication of CINDA 76/77 in spring 1976. The work on CINDA was continued with particular emphasis on completeness, increased linkage to EXFOR, and a more cost effective publication schedule.

In the field of charged particle nuclear data (CPND) a communication network for the exchange of data and information between all presently existing CPND centres and groups has been established and is being coordinated by NDS. A similar cooperation and a sharing of work between the existing and new data centres and groups has been agreed in 1976 in the field of mass chain nuclear structure and decay data.

During the reporting period the Agency's governing organs have approved the addition of the new programme on atomic and molecular data for fusion for a trial period of two years (1977 and 1978). Accordingly, the new Atomic and Molecular (A+M) Data Unit of NDS has been inaugurated in January 1977.

A subcommittee, formed of members from the Agency's International Fusion Research Council (IFRC) and the INDC, has the task to review the Agency's A+M data programme during the trial period and to recommend to the Director General whether the trial programme should be converted to a continuing programme after 1978. Following the recommendations of this subcommittee and the findings of an Advisory Group Meeting on Atomic Data for Fusion, which the Agency convened at the Culham Laboratory in the UK in November 1976, the attention of the trial programme will initially be focussed on the publication of a quarterly bulletin with new A+M data information, the compilation and publication of an international reference index on atomic collision data, and on the development of a common system for the exchange of bibliographic and numerical A+M data between the cooperating data centres and groups.

A. INDC SECRETARIAT

A.1. Compendium of Committee Regulations

In its function as secretariat to the International Nuclear Data Committee (INDC) NDS has issued an updated version of the Compendium of Committee Regulations (INDC-23/L) in September 1976. This report is available on request from NDS.

A.2. Liaison Officers

The following changes in the membership of INDC Liaison Officers have occurred in the course of this reporting period:

German Democratic Republic:

Prof. Dr. D. Seeliger
has replaced Dr. K. Seidel

Korea, Democratic People's Republic:

Dr. S.H. Dzang
has been appointed Liaison Officer

Kuwait:

Dr. A. Shihab-Eldin
has been appointed Liaison Officer

Thailand:

Mr. W. Boonkong
has replaced Mr. Th. Nimwanadon

The current list of Liaison Officers to the INDC comprizes scientists from 41 IAEA Member States; the list is given in Appendix 1.

As in previous years, INDC Liaison Officers have been asked to submit progress reports in time for distribution at the INDC meeting (May 1977). Progress reports submitted by countries not directly represented on the INDC, have been compiled into two consolidated reports: one for those countries which are in the NDS service area, published as INDC(SEC)-61/L, and another for those outside the NDS service area, published as INDC (SEC)-62/L.

A.3. List of Correspondents

The current list of INDC Correspondents for the exchange of nuclear data information has been distributed in November 1976 as INDC(SEC)--56/U+N. The next issue of this list will be published in May 1977.

In addition to the formal INDC distribution codes G, L, U and N (defined in the latest List of INDC Correspondents), the INDC Secretariat has assigned additional distribution codes for the distribution of reports of special interest to a limited number of people, interested in specific aspects of nuclear data or in atomic and molecular data.

The "special interest" distribution codes currently used for the dissemination of some INDC documents, in addition to the G, L, U, and N distribution codes, are:

A - Distribution code for atomic and molecular data (A+M) documents concerning the international effort in the field of A+M data for fusion. This group of recipients consists of INDC and IFRC Committee members, heads of data centres, and key personnel responsible for the measurement, compilation, evaluation and dissemination of A+M data.

B - Distribution code for technical reports on the measurement or calculation of A+M data, data evaluations, surveys and compilations, and progress reports. This group of recipients consists of the A distribution plus representatives of all groups of A+M data users and producers (i.e. measurers, theoreticians and evaluators).

D - Recipients of the "CINDU" Catalogue of Numerical Nuclear Data Available from the IAEA Nuclear Data Section.

F - Nuclear Data for Fusion.

H - Transactinium Isotope Nuclear Data.

M - Reactor Dosimetry Nuclear Data.

P - Fission Product Nuclear Data.

R - Recipients of "WRENDA" World Request List for Nuclear Data.

S - Nuclear Material Safeguards.

T - NDS Targets and Samples Programme.

Y - Nuclear Theory and Computer Codes for Nuclear Data Calculations.

A.4. List of Documents

The current list of INDC documents received and distributed by the INDC Secretariat has been published as INDC(SEC)-59/U.

In order to implement the distribution system for "non-neutron" nuclear data documents and reports, all producers of "non-neutron" nuclear data documents in every participating Member State are asked to comply with the INDC document distribution instructions (i.e. as to the method of nomenclature to be used and the number of copies to be sent to the INDC Secretariat) given in the "List of Documents Received by the INDC Secretariat" (INDC(SEC)-59/U) and the "List of INDC Correspondents" (INDC(SEC)-60/U) which is to be published in April 1977.

"Non-neutron" nuclear data reports received as single (or few) copies by the INDC Secretariat, for which no INDC distribution is requested, will be listed in the annually published "List of Documents Received by the INDC Secretariat", together with the neutron data documents received as single copies.

The INDC Secretariat is continuously concerned that many nuclear physics reports related to the measurement or evaluation of nuclear data, such as laboratory reports generated in participating Member States, do not get the adequate dissemination they should have. It therefore urges all responsible for the dissemination of nuclear data information to distribute more documents through the established INDC channels (L, U and N distributions).

A.5. Translation of Documents

Subject to available funds, the IAEA translates a limited number of INDC reports submitted by the Soviet Union.

During the reporting period 37 nuclear data reports of Soviet origin have been translated by the IAEA into English and distributed as INDC documents. Their full titles are given in the latest List of INDC Documents, INDC (SEC)-59/U.

A.6. Compilation of National Nuclear Data Committees

The 1976 issue of the Compilation of National Nuclear Data Committees has been published as INDC(SEC)-58/LN and distributed in February 1977. It supersedes the 1975 compilation, INDC(SEC)-49/L.

In view of the growth and personnel turn-over of national nuclear data committees, INDC Members and Liaison Officers are urged to ascertain that all members of those committees be included in the list of INDC Correspondents (see A.3. above).

B. MEETINGS

B.1. Past Meetings (September 1975 - February 1977)

B.1.1 First Consultants' Meeting on Charged Particle Nuclear Data (CPND) Compilation, Vienna, 8-12 September 1975

This meeting was a sequel to the IAEA Consultants' Meeting on Charged Particle and Photonuclear Reaction Data held in Vienna 24-26 April 1974. That earlier meeting concluded that the valuable services provided by the existing centres and groups could be usefully enhanced by establishing a coherent international cooperation in the compilation, evaluation and dissemination of these data. This cooperation would require a free international exchange of experimental as well as evaluated data between the centres and groups concerned.

Following the 1974 CPND meeting and the deliberations and recommendations of INDC at its Seventh Meeting in October 1974, essential steps were taken towards establishing international cooperation in the compilation and exchange of charged particle nuclear data. The charged-particle nuclear data group at Karlsruhe prepared sample entries of charged-particle reaction data compiled in a modified version of the original EXFOR format, which had been developed by the four neutron data centres for the exchange of neutron nuclear data. The modified EXFOR version as proposed by Karlsruhe was subsequently reviewed by the four neutron data centres at their March 1975 meeting. The Centre for Nuclear Structure and Reaction Data (CAJaD) at the Kurchatov Institute in Moscow, USSR, submitted sample entries in the modified EXFOR format. Furthermore, a study group in Japan developed the prototype of a Nuclear Data File, and in the USA, the National Neutron Cross-Section Center assumed responsibility for coordinating the US activities on charged-particle nuclear data with similar activities abroad.

On the basis of the conclusions of the 1974 CPND meeting and of the developments which took place thereafter, the 1975 meeting was the first to discuss technical details of an international agreement for the compilation and exchange of charged-particle nuclear data. The minutes of the meeting are published in the document INDC(NDS)-69/G.

B.1.2 ASTM-EURATOM Symposium for Neutron Irradiation Dosimetry for International Standardization, Petten, Netherlands, 22-26 September 1975

The main topics of the symposium

- measurements of neutron and gamma field characteristics with emphasis on inpile material irradiation; and

- radiation damage of structural and fuel materials

were discussed in six separate sessions: needs, required accuracies and implications; spectrometry, activation and unfolding calculations; reaction rate measurements; dosimetry applications; damage analysis; and cross sections and benchmarks. The following five workshops were held in the course of the week, three of these (listed first) were of direct pertinence to the Agency's nuclear data programme:

- unfolding of measured spectra,
- reactor neutron dosimetry benchmarks,
- high energy dosimetry and CTR applications,
- solid state track recording, and
- dosimetry materials with emphasis on high temperature applications.

M. Vlasov of NDS attended the meeting and presented a report on the status of neutron activation cross sections for reactor dosimetry during the workshop on "high energy dosimetry and CTR applications". The Agency's new programme on the "Application of Benchmark Neutron Fields to Reactor Dosimetry" (see Section C.3.1) was discussed in detail at the workshop on benchmarks and at a plenary session of the symposium and received strong support. The programme is described in report INDC(SEC)-54.

B.1.3 IAEA Advisory Group Meeting on Transactinium Isotope Nuclear Data, Karlsruhe, Federal Republic of Germany, 3-7 November 1975

In response to the growing importance of actinides in nuclear technology NDS, in cooperation with the OECD Nuclear Energy Agency, convened for the first time an Advisory Group Meeting on Transactinium Isotope Nuclear Data whose purpose was to bring together users and producers of such data in order to survey the needs and to review the status of these data, and to recommend guidelines for future work. The meeting was attended by 45 scientists from 13 countries and 3 international organizations.

The meeting was organized around seventeen comprehensive review papers (Appendix 2), covering the full scope of applications in one session, and an extensive review of the status of transactinium nuclear data in a second session. These review papers provided the basis for the discussions during the first three days of the meeting and for the preparation of the conclusions and recommendations during the last two days of the meeting.

The meeting produced one set of general recommendations and three reports on each of the three general areas of applications *, each with its own conclusions and recommendations, and comparisons of transactinium isotope nuclear data requirements and status.

* = (thermal reactors, fast reactors, waste management and isotope applications)

It was the general conclusion of the meeting participants that the present knowledge of nuclear data required to evaluate the effects of actinides in nuclear technology is not satisfactory. One of the basic recommendation which resulted from the meeting was therefore to implement an internationally coordinated ten years programme to measure, calculate, and evaluate transactinium isotope nuclear data required for nuclear technology, with the aim to improve the status and accuracy of these data.

The conclusions and recommendations which resulted from this meeting have been published in INDC(NDS)-74/LH and the review and contributed papers written specifically for this meeting have been published separately in the IAEA report IAEA-186 (in 3 volumes).

B.1.4 NEA CINDA Readers Seminar, Neutron Data Compilation Centre (NDCC), Saclay, 17-18 November 1975

The objectives of the CINDA Readers Seminar which was organized upon recommendation by the NEA NDCC Committee, were:

- to bring together, for the first time, all the persons indexing in CINDA the literature from NDCC's service area,
- to familiarize the indexers with the whole CINDA system and its organization,
- to make attempts to officialize the CINDA indexing at the indexers' home-laboratories, and
- to improve the coverage of scientific literature and the control system.

Mrs. G. Lammer, the CINDA-compiler for the NDS service area attended this seminar as IAEA observer. As such she was able to give advice on the basis of her own experience and to present the views of NDS to several points of the discussions.

The minutes of this seminar are published as a report of the NDCC.

B.1.5 IBM course on "Improved Programming Techniques", held in London, England, 1-5 December 1975

P.M. Smith of the programming unit of IAEA/NDS attended a computer programming course which covered the following topics:

- Top-down Development
- Hierarchy Input, Process, Output (HIPO)
- Team Operations
- Development Support Libraries

- Structured Programming
- Program Design Languages
- Structured Design
- Structured Walkthroughs

The use of the above techniques has proven to improve programming productivity and several of them have been successfully used for new system development at IAEA/NDS.

B.1.6 IAEA Consultants' Meeting on the Use of Nuclear Theory in Neutron Nuclear Data Evaluation, International Centre for Theoretical Physics (ICTP), Trieste, 8-11 December 1975

This meeting, recommended by the INDC and convened by IAEA/NDS in cooperation with the ICTP in Trieste, had the objectives to review the status and the use of nuclear theories, models and computer codes in the evaluation of neutron nuclear data needed for fission and fusion reactor design and other nuclear applications, and to work out recommendations for future developments, with particular consideration of the requirements and possible cooperation of nuclear scientists from developing countries. The summary report of the meeting has been published as INDC (NDS)-73/L and the full proceedings of the meeting have been published in the IAEA Technical Report IAEA-190, Vols. I and II.

The meeting demonstrated the importance of current research in basic nuclear theory for an improved understanding and determination of nuclear model parameters, a more adequate and detailed description of nuclear properties and reactions and thus for improvements in the prediction of neutron nuclear reaction data needed in nuclear energy applications. Eight review and twenty contributed papers presented in plenary followed by working group discussions formed the basis for a detailed review of the current and required developments in the following areas of nuclear theory:

- resonance and statistical theory
- capture mechanism
- nuclear level densities
- optical model
- pre-compound decay
- fission theory

and included a survey of available and required nuclear model computer codes performed by the NEA Computer Programme Library. The meeting was thus in keeping with the traditional nuclear theory activities of the ICTP. Appendix 3 lists authors and titles of the invited review papers.

The most important result of the meeting was the recommendation of an extended seminar of several weeks duration on nuclear theory and nuclear model computer codes for applications to be held in 1977. As appropriate places the meeting suggested the ICTP in Trieste for the nuclear theory part, and the Centro di Calcolo of CNEN in Bologna or the NEA Computer Programme Library at Ispra for the computer code part of the seminar. The implementation of this recommendation is outlined in section B.1.19 of this report.

The meeting was attended by 39 scientists from 16 countries and three international organizations. The excellent assistance by staff from the ICTP and the Institute of Theoretical Physics of the Trieste University contributed greatly to the success of the meeting.

B.1.7 IAEA Technical Committee Meeting on the Treatment of Nuclear Data Sources in INIS, Vienna, 1-2 April 1976

This technical committee was convened jointly by the INIS and Nuclear Data Sections upon the recommendation expressed by the INIS Liaison Officers at their meeting in Vienna, 7-9 October 1975. Its original purpose was to study the means and methods of identifying documents which contain relevant nuclear data and which are reported to INIS. After a period of informal contacts between INIS and NDS, this was the first formal meeting for discussing interface problems between representatives of INIS and the Neutron Data Centres.

To some extent INIS retrievals and the INIS Atomindex are currently being used by the data centres. However, these retrievals include too large a fraction of noise because INIS so far does not have a data classification scheme allowing retrievals adequate for the purposes of neutron data centres. The interest of these centres is therefore that the INIS retrieval facilities be improved to assist the data centres in their current awareness of new literature about neutron data. Whereas the more important periodicals must continue to be scanned regularly by the data centres, the access to data information in less important literature (containing relevant papers only occasionally) could economically be done by a regular INIS retrievals service.

The meeting discussed several conflicting proposals for the tagging and flagging of nuclear data references in INIS and generally recommended that some form of data indexing should be adopted by INIS to assist in the identification of literature containing numerical data and that this should be done as much as possible within the existing structure and format of INIS input requirements.

The summary of the meeting was released as IAEA TC (Technical Committee) report TC-82/10. The formal recommendations which have resulted from this meeting are included in Appendix 4.

At present a Consultant to the INIS Section is working out a compromise proposal, taking into account all the views and proposals expressed in the past including a proposal by NDS. The scheme for data flagging in INIS to be recommended by this Consultant and its adequacy will be tested in selected national INIS centres and in at least one neutron data centre.

B.1.8 12th Annual Consultants' Meeting of the Four Neutron Nuclear Data Centres ("Four Centre Meeting"), Vienna, 26-27 April 1976

and

B.1.9 2nd Consultants' Meeting on Charged Particle Nuclear Data Compilation ("CPND Meeting"), Vienna, 28-30 April 1976

These two meetings were closely related due to the discussions on the EXFOR system commonly used for the exchange of both data types, and most of the participants of the first of the two meetings stayed for the second. Both meetings together can be regarded therefore as the First Consultants' Meeting of Nuclear Reaction Data Centres - though photonuclear reaction data was not a topic of the meeting. The list of centres and groups participating in the CPND network is given in Appendix 5, the combined list of participants for both meetings is given in Appendix 6, and the agenda of the Twelfth Four-Centre Meeting is given in Appendix 7.

The minutes of the meeting of the Neutron Data Centres have been issued in report INDC(NDS)-78, and the minutes of the Charged Particle Nuclear Data Meeting are contained in report INDC(NDS)-77. Both documents include all the decisions on the EXFOR system irrespective from which of the two meetings they resulted.

In line with the established objectives of the Annual Consultants' Meetings of the Four Neutron Nuclear Data Centres, the discussions were mainly concentrated on technical details of the computerized systems: CINDA, EXFOR, WRENDA and various evaluated data libraries. The major consequences from the conclusions of this meeting affecting the data centre activities of NDS are discussed in section D of this report.

The objective of the Meeting on Charged Particle Nuclear Data Compilation was to establish among various interested centres and groups a world-wide cooperation in the compilation of CPND, similar to the long-standing cooperation among the four neutron data centres.

The situation with charged particle nuclear data (CPND) differs from that of neutron nuclear data (NND) in the following respects:

- whereas practically all NND are important for application purposes, only a fraction of the vast amounts of available CPND is important for applications. Main emphasis of the

CPND cooperation is put on "integral" CPND comprising cross-sections as a function of energy, thick-target yields, and selected angular distribution data;

- whereas the stimulus for NND compilation centres came originally from the fission reactor projects concentrated in large research laboratories, the need for CPND compilation comes from a larger number of different applications. Correspondingly there seems to be a number of smaller groups active in CPND compilation which have much to gain from a coordinated international effort. Besides NEA and IAEA, there are 13 centres and groups in 9 countries, including 3 developing countries, who are presently cooperating in the compilation or dissemination of CPND.

The participants attending the CPND meeting decided

- to promote and actively support the international cooperation efforts to compile CPND and make them available to data users,

- to urge the funding bodies of the participating groups to continue to support the activities of these groups on a long-term basis,

- to minimize difficulties and optimize the efficiency of CPND exchange by the adoption of common formats whenever possible, and

- to urge the participating organizations to give high priority to the responsibilities which each of the participating groups assumed within the network operations for CPND.

It was also agreed that:

- A data index for integral CPND will be created, probably in a form close to CINDA. After defining the format of the computerized file, which will be maintained at NNCSC, USA, the Agency will be asked to consider printing the index in handbook form, similar to CINDA. This index, however, will be much smaller than CINDA, perhaps a few hundred pages per year.

- The compilation of experimental data will be done in EXFOR format. NDS will not participate actively in CPND compilation, but will keep the data files compiled by the CPND centre network, will advertise them and make them available upon request.

- As the EXFOR format was originally developed for neutron nuclear data, it will require some extensions to allow for features specific to CPND. NDS will supervise the further development of EXFOR and maintain a CPND EXFOR Manual.

- In view of the number of CPND compilation groups which have to implement the operation of the EXFOR system on their respective computers, it would save considerable programming efforts if NDS could provide them with the required EXFOR programmes.

B.1.10 IAEA Advisory Group Meeting on Nuclear Structure and Decay Data, Vienna, 3-7 May 1976

The Advisory Group Meeting on Nuclear Structure and Decay Data for Applications was convened by IAEA/NDS on the recommendation of the International Nuclear Data Committee and of the May 1974 IAEA Specialists' Meeting on Nuclear Data for Applications. The meeting was attended by 26 scientists from 13 countries and 2 international organizations representing all centres and groups concerned with the compilation, evaluation and dissemination of nuclear structure and decay data. The list of participants is given in Appendix 8. A detailed account of the meeting proceedings has been published in the report INDC(NDS)-79/LN.

The principal objective of this meeting was the formation of an internationally coordinated network of centres, groups and individuals for the systematic compilation, evaluation and dissemination of nuclear structure and decay (NSD) data.

In particular the meeting aimed at obtaining commitments from existing centres and groups to share in the overall effort of compilation and evaluation of mass chain NSD data in order to achieve a continuous and complete evaluation of all mass chains on a four year cycle. Furthermore, as an adjunct to the establishment of the evaluation network, the meeting intended to define common bibliographic and numerical data exchange formats, discuss the concept and content of an international file of evaluated NSD data, and agree on common rules and methods of mass chain data evaluation.

The main conclusions of the meeting were:

- The meeting confirmed the need for a world-wide cooperative evaluation effort and endorsed the free exchange of nuclear structure and decay data.

- A network of centres and groups for the evaluation of mass-chain NSD data was established, and preliminary ranges of responsibility have been assigned; a total of ten centres, including the original cooperating mass-chain evaluation cen-

tres have agreed to participate in this effort, and seven others have expressed their intention to join this effort in the future.

- The meeting decided to separate horizontal data compilations from vertical or mass-chain data compilations, and has given the responsibility to the IAEA Nuclear Data Section to maintain a compilation of horizontal NSD data compilations and evaluations, and to publish this compilation periodically (see section D.2.2).

- The meeting agreed that bibliographic references pertinent to NSD data be compiled and exchanged in the format of "Recent References", an existing computerized system developed by the US/NDP* and used for the storage, retrieval and publication of bibliographic NSD data.

- The meeting agreed that numerical NSD data be compiled and exchanged in the format of the Evaluated Nuclear Structure Data File ENSDF, an existing computerized system developed by the US/NDP and used for the storage, retrieval and publication of numerical NSD data.

- The meeting defined the nature and scope of international bibliographic and numerical NSD data files which are to serve as the universal master files for all NSD data, and the responsibilities for their maintenance and distribution.

- The meeting agreed on a network of centres for the coordination of activities and for the dissemination of NSD data.

- The meeting discussed the publication of NSD data, endorsed for the time being the continuation of the established NSD data publications in Nuclear Data Sheets and Nuclear Physics, and welcomed the US offer to publish periodically a Wallchart of Nuclides and a Handbook of Isotopes.

- The meeting discussed various ways and means to maintain the uniformity and quality of NSD data evaluations, and urged all participating centres and groups to give them serious consideration.

- The meeting established channels of communications between all members of the network, and assigned the IAEA/NDS to serve as the central repository of all communications and documents pertinent to the international NSD data network.

- The meeting agreed that the next meeting of the NSDD centres and groups be convened in September 1977, the place being either in the USSR or in the USA.

* Nuclear Data Project, located at the Oak Ridge National Laboratory in the USA.

B.1.11 International Conference on the Interaction of Neutrons with Nuclei, Lowell, Mass., USA, 6-9 July 1976

The Conference was sponsored by the University of Lowell together with the International Union of Pure and Applied Physics (IUPAP), the American Nuclear Society (ANS), the American Physical Society (APS), the US National Science Foundation (NSF), and other organizations. It was attended by 332 participants from 26 countries. 215 participants were from the USA.

The aim of the Conference was to survey the advances in neutron physics, particularly over the past decade, to review the present status of this field, and to assess the future potentialities for its development from a theoretical, experimental and technological standpoint.

The contributed papers presented at this meeting fell in the following twelve categories which give an idea of the main topics discussed at the Conference (number of papers presented in each category is given in parentheses):

A.	Neutron Properties and Forces	[8 papers]
B.	Resonance Neutrons	[19 papers]
C.	Neutron Facilities	[5 papers]
D.	Photoneutrons & Radiative Capture	[24 papers]
E.	Neutron Scattering	[23 papers]
F.	Neutron-Induced Reactions	[14 papers]
G.	Polarization	[8 papers]
H.	Instrumentation	[11 papers]
I.	Standards and Data	[14 papers]
J.	Fission and Fusion	[19 papers]
K.	Theoretical Physics	[37 papers]
L.	Miscellaneous Topics	[7 papers]

M. Vlasov of the Nuclear Data Section was invited to attend this conference and to present a special contributed review paper on the "Status of Neutron Cross Sections for Reactor Dosimetry" (coauthored with A. Fabry and W.N. McElroy). The paper, which is also to be distributed as report INDC(NDS)-84/L describes the present status of neutron activation cross sections for some threshold reactions of importance in the field of reactor neutron dosimetry, discrepancies between integral and differential data, and the importance of benchmark neutron fields for the validation and improvement of neutron dosimetry data.

B.1.12 Fifth Biennial International CODATA Conference, 28 June - 1 July 1976, Boulder, Colorado, USA

A staff member of the Nuclear Data Section, A. Lorenz submitted a paper to this Conference but was not able to attend because of restricted travel funds. The paper entitled "The IAEA Nuclear Data Center, its Role in the International Scientific Community", is included in the proceedings of this meeting which were published in the CODATA Bulletin No. 21 (October 1976); it has also been distributed as report INDC(NDS)-76.

B.1.13 19th Meeting of NEANDC, Stockholm, 20-24 September 1976

As IAEA observer, J.J. Schmidt attended the 19th Meeting of NEANDC, which took place at Stockholm, Sweden, from 20-24 September 1976. The highlights of this meeting were as follows:

NEANDC continues to concentrate the scope of its activities on nuclear data required for fission and fusion reactor development. At this meeting the Committee in particular

- reviewed the progress in the accurate determination of important standard reference, thermal and fast reactor nuclear data and acknowledged the excellent cooperation between the technical subcommittees of INDC and NEANDC in this respect;

- discussed the coordination of future NEA and IAEA sponsored nuclear data meetings, the organisation and programme of the International Conference on Neutron Physics and Nuclear Data to be held at AERE Harwell, UK, 25-29 September 1978 and to be sponsored by OECD/NEA and UKAEA, and approved IAEA cooperation in this Conference;

- discussed topics and possible authors for nuclear data monographs specifically designed for the training of nuclear physicists in the fundamentals of nuclear data; and

- opposed strongly the abandoning of the universally accepted use of the "barn" unit for nuclear cross sections which was recently recommended by the European Communities.

It appears that the decisions to eliminate the barn have been taken with almost no consultation with the nuclear community. While no immediate action was suggested in this matter to the IAEA, NEANDC concluded to publish a note against abandoning the barn in the major nuclear journals and recommended to its members to contact their national and regional physics societies in this matter to get the decision of the Council of Ministers of the European Communities reverted.

The topical discussion reviewed integral and differential afterheat measurements in Japan, Sweden, UK and USA important for reactor safety. Comparisons of measurements and calculations of decay heat reveal discrepancies for short decay times below 10 sec due to unsatisfactory knowledge of short-lived fission product nuclear decay data. The IAEA/NDS Panel on Fission Product Nuclear Data (FPND) held in Bologna in 1973 had first identified this gap and stimulated particularly in Sweden a systematic measurement programme on β-decay data for short-lived fission products. Prof. Rudstam's report on the first results of this outstanding work was the high-light of the topical discussion. He is invited by IAEA/NDS to present a full account of his work for more extensive discussion at the forthcoming Second IAEA Advisory Group Meeting on FPND to be held in Petten, Netherlands, in September 1977.

The technical agenda of the meeting and the list of participants are given in Appendices 9 and 10.

B.1.14 Joint IAEA-OECD(NEA) Technical Committee Meeting on Differential and Integral Nuclear Data Requirements for Shielding Calculations, Vienna, 12-15 October 1976

This meeting was jointly organized by the IAEA (cooperation between the Advanced Nuclear Power Technology Section and NDS) and the OECD Nuclear Energy Agency and follows a related jointly sponsored meeting held in Paris in 1975. About 40 participants from 14 countries and 3 international organizations took part in the meeting.

The overall objective of the meeting was to assess, on an international basis, the requirements for both differential and integral nuclear data to meet shield design objectives. A primary tool for this assessment was to be quantitative sensitivity studies of integral experiments and benchmark shield designs. Originally emphasis was placed on compiling a differential cross section measurement request list to meet design goals or, alternatively, to ascertain whether cross-section adjustment could meet the same goals.

The proceedings focussed on five major areas of interest:

1. sensitivity studies of benchmark shield designs and integral experiments for thermal and fast fission reactors,
2. assessments of the status of current differential and integral nuclear data,
3. nuclear data needs for future shield design work,
4. common ground between data requirements for fission and fusion shield designs and
5. target accuracies.

At the conclusion of the meeting summaries for each area of interest were made by editorial panel members. The papers and summaries will be published by the IAEA. Summary remarks from NDS are given in Appendix 11.

B.1.15 IAEA Advisory Group Meeting on Atomic and Molecular Data for Fusion, Culham, UK, 1-5 November 1976

IAEA/NDS convened an Advisory Group Meeting on Atomic and Molecular Data for Fusion at the UKAEA Laboratory at Culham, from 1-5 November 1976. This first international meeting on this topic was attended by 88 scientists, representing both the technical fusion and the academic atomic physics communities, from 18 countries and 2 international organizations.

Twentyone papers describing atomic and molecular data needs in fusion research and technology, and outlining national programmes and emphasis in this field were presented. The meeting agenda is given in Appendix 12. Three detailed working group reports identifying requirements and availability of atomic collision data, atomic structure data, and surface interaction data in fusion research were produced by the participants. The working group reports are to be published in a summary report of the meeting as report INDC(NDS)-82/GB. The full proceedings of the meeting will be published as an IAEA Technical Report. The meeting recognized that the needs for atomic and molecular data for the development of fusion research and technology are so large that any one Member State cannot adequately fulfil these needs for the whole world. Thus, not only was it deemed necessary to coordinate the collection of the requirements and the acquisition of the required data on atomic and molecular processes, but also to create a network of data centres for the dissemination of these data to the fusion community. The meeting recommended the formation of an international network of data centres for the compilation and dissemination of atomic and molecular data required for fusion, and recommended that the IAEA Nuclear Data Section be given the responsibility to establish and coordinate this network.

B.1.16 First Meeting of the Joint IFRC/INDC Subcommittee on A+M Data for Fusion, Culham, UK, 5 November 1976

The first meeting of the Joint IFRC/INDC Subcommittee on A+M Data for Fusion was held at the Culham Laboratory on 5 November 1976, immediately following the meeting on A+M Data for Fusion (see B.1.15 above). The composition of the subcommittee and the list of participants of this meeting are given in Appendix 13.

Formed specifically to advise the Director General of the IAEA on its A+M data for fusion programme, and to review its progress and achievements during its trial period, 1977-1978, the subcommittee reviewed the recommendations of the four working groups of the A+M Data for Fusion Meeting, and discussed the proposed IAEA A+M data programme for 1977-1978.

The minutes of this meeting have been published in report INDC(SEC)-57/GA. The next meeting of this subcommittee was scheduled for 14 May 1977.

B.1.17 IAEA Consultants' Meeting on Integral Cross-section Measurements in Standard Neutron Fields for Reactor Dosimetry, Vienna, 15-19 November 1976

This meeting has been held on the recommendation of the September 1973 IAEA Consultants' Meeting on Neutron Data for Reactor Dosimetry (INDC (NDS)-56/U), and was also supported by the International Working Group on Reactor Radiation Measurements (IWGRRM) and the INDC. This meeting can be considered as one of the first steps of the IAEA programme on "Benchmark Neutron Fields Applications for Reactor Dosimetry (INDC(SEC)-54).

The objectives of the meeting were:

- to reach as far as possible a consensus regarding the status of reactor dosimetry neutron data;
- to identify the availability of pertinent benchmark neutron fields, and to specify their spectral characterization; and
- to work out specific recommendations for future efforts in this field.

The meeting was divided into six sessions:

1. Overview
2. Spectral characterization of benchmark neutron fields
3. Integral data in benchmark neutron fields
4. Differential cross-section data for reactor dosimetry
5. Validation and adjustment of differential cross-sections on the basis of integral data
6. Conclusions and recommendations to the IAEA.

The meeting was attended by more than 20 participants. (The list of participants is given in Appendix 14). 44 papers were presented and discussed. The summary report of the meeting has been published as INDC(NDS)-81, and the proceedings of the meeting are in preparation for publication as an IAEA technical report. The main conclusions and recommendations of the meeting are given in Appendix 15.

B.1.18 IAEA Consultants Meeting on the Evaluation of Actinide Neutron Cross Sections, Vienna, 13-14 December 1976

(see also section C.6)

This meeting was convened in response to a recommendation by the IAEA Advisory Group Meeting on Transactinium Isotope Nuclear Data (TND) which was held at Karlsruhe, Fed. Rep. of Germany, 3-7 November 1975. That meeting recommended that "... an internationally coordinated effort be implemented and pursued during the next ten years so as to improve the status of transactinium neutron nuclear data required for nuclear technology". It suggested specifically that "this international effort should comprise a coordinated programme for the evaluation of transactinium isotope neutron nuclear data".

The objective of the meeting was to investigate the feasibility of a coordinated programme for the evaluation of actinide neutron cross sections. The meeting was attended by representatives from France, Federal Republic of Germany, India, Israel, Japan, Romania and UK. These countries, together with the USSR and Italy, form the potential candidates for participation in such a coordinated programme.

The meeting first reviewed the recommendations of the Karlsruhe Advisory Group. Then each of the participants outlined the national programme for actinide neutron data evaluations intended by his country for the periods 1977-79 and 1980-86. These programmes so far reveal a strong overlap for several actinides, while some other actinides of almost equal importance are not covered at all at least in the initial period 1977-79. The meeting, while agreeing in principle on the usefulness of a coordinated evaluation programme, suggested that in order to reduce duplication of work and to cover a larger range of nuclides, some bilateral cooperative agreements be sought between the countries concerned before a multilateral evaluation programme is started and supported by the IAEA. The deadline for reaching bilateral agreements was fixed at 31 March 1977.

B.1.19 IAEA Consultants' Meeting on Nuclear and Reactor Theory and Associated Computer Codes, Vienna, 15-16 December 1976

In the fall of 1976 IAEA and ICTP agreed to organize two related Winter Courses on Nuclear Theory for Applications and on Reactor Theory and Power Reactors and to hold them at the ICTP from 16 January to 10 Feb-

ruary 1978 and from 13 February to 10 March 1978 respectively. The first course is convened pursuant to the recommendation of the IAEA Consultants' Meeting on the Use of Nuclear Theory in Neutron Nuclear Data Evaluation, held at the ICTP in Trieste, 8-11 December 1975 (see section B.1.6) and in response to the interest expressed by more than 30 countries, among which 15 developing and 10 smaller developed countries, upon an informal enquiry conducted by NDS during 1976. This course will be technically organized and financed by NDS. The second course is convened in response to an interest expressed by several developing countries to the ICTP. It will be technically organized by the Advanced Nuclear Power Technology Section of the Division of Nuclear Power and Reactors of the IAEA and financed by the ICTP. The Centro di Calcolo of the Italian Comitato Nazionale per l'Energia Nucleare (CNEN) will cooperate in this course by organizing reviews of typical computer codes for power reactor calculations. The technical coordination of both courses at the IAEA rests with NDS. The Scientific Council of the ICTP at its meeting end of February 1977 will be asked for approval of both courses.

The objective of the small Consultants Meeting convened in Vienna on 15-16 December 1976 was to determine the purpose and to give advice on the overall programme of the two courses. The purpose of the Nuclear Theory Course will be to review thoroughly the state of the art of low energy nuclear reaction theory and to train post-doctoral nuclear scientists from developing countries in the application of the theory and of selected important computer codes to the computation of neutron nuclear data needed for nuclear reactor calculations. The purpose of the Reactor Theory Course is to offer post-doctoral nuclear scientists and engineers from developing countries a broad and thorough review of reactor theory and applications in the light of engineering requirements for power reactor design and operation. The courses will be conducted in the form of extended lectures to be delivered by leading scientists in the field. More information including a programme outline can be found in Appendix 16.

B.1.20 OECD/NEA Specialist Study Meeting on the Use of Generalised Data Base Management Systems (DBMS) in Specialised Information Centres, Paris, 11-13 January 1977

P.M. Attree participated in the meeting, the purpose of which is to produce a report aimed at programmers, scientists and managers concerned in particular with the handling of numerical data in specialised information projects or data centres. The report should give a clear introduction to DBMS and how they may be useful, include case studies of different DBMS applications to scientific data handling to show what is involved and survey future developments expected in DBMS and their present limitations.

The meeting was of particular interest to NDS because the ADABAS system (a DBMS) will become available for use in the Agency during 1977.

B.2. Meetings Planned for 1977

B.2.1 International Specialists Symposium on Neutron Standards and Applications, Gaithersburg, Md., 28 March - 1 April 1977

The purpose of the symposium will be to assess progress in neutron standards, to review the spectrum of applications of neutron standards and to establish direction for future work. The IAEA has cooperated in this meeting to the extent of providing financial support for the participation of selected scientists from developing countries.

Although invited to present a paper on the Agency's evaluation of thermal fission neutron data, H.D. Lemmel from NDS who has been in charge of this effort, could not attend the meeting because of other commitments. The meeting will be attended by another NDS staff member, M. Vlasov, in his capacity as expert on neutron data for reactor dosimetry.

B.2.2 2nd Annual IAEA Consultants' Meeting of Nuclear Reaction Data Centres, Kiev, USSR, 11-16 April 1977

This Meeting will combine the

> 13th Consultants' Meeting of the Four Neutron Nuclear Data Centres ("13th 4C-Meeting")

and the

> 3rd Consultants' Meeting on Charged Particle Nuclear Data Compilation ("3rd CPND-Meeting").

Part of the sessions will be held in common in order to discuss the commonly operated EXFOR system for the exchange of numerical experimental nuclear reaction data. Other sessions will be specific either to neutron data (e.g. CINDA, WRENDA, evaluated data exchange) or to CPND (e.g. bibliography). The use of EXFOR for the possible inclusion of photonuclear reaction data will also be discussed.

Nuclear structure and decay data will not be a topic of the meeting, except where such data are basic to nuclear reaction data and therefore included in compilations of such data.

The tentative agenda for this meeting is given in Appendix 17. Special emphasis will be given to:

- details of the generalized EXFOR system for all types of nuclear reaction data,
- the gradual change-over of the neutron-data exchange from the earlier neutron EXFOR system to the generalized EXFOR system, and
- improvements of the CINDA-system and its future publication schedule.

B.2.3 All-Union Conference on Neutron Physics, Kiev, USSR, 18-22 April 1977

The Nuclear Data Section has been invited to attend this Conference and intends to send one or two participants.

B.2.4 First IAEA Meeting of the A+M Data Centre Network, Vienna, 9-13 May 1977

At the November 1976 Culham meeting on A+M Data for Fusion, it was recommended that an international network of A+M data centres be formed; its task will be to compile and disseminate bibliographic and numerical A+M data required for fusion. The current membership of this network is given in Appendix 18.

The first meeting of these data centres is planned to be held at IAEA Headquarters 9-13 May 1977; it will have as its overall objective the formulation and adoption of common operational procedures for the co-ordination of the world-wide compilation, evaluation, exchange and dissemination of A+M data for fusion.

B.2.5 Second Meeting of the Joint IFRC/INDC Subcommittee on A+M Data for Fusion, Vienna, 14 May 1977

The second meeting of the Joint IFRC/INDC Subcommittee on A+M Data for Fusion is planned to be held on 14 May 1977. (The first meeting of this subcommittee was held 5 November 1976, see section B.1.16, this report). The Subcommittee is to consider the following topics:

- IAEA/NDS A+M data programme, assessment of tasks,
- Establishment of network of A+M Liaison Officers,
- Interaction between fusion and academic atomic physics community,
- A+M data publication, and
- Continuation of the Agency's A+M data programme beyond 1978.

B.2.6 Tenth International Conference on the Physics of Electronic and Atomic Collisions, Paris, 21-27 July 1977

A proposal to include a session on critical evaluation and compilation of cross section data of electronic and atomic collisions with a view to application to fusion research is under consideration by the organizing committee. It is being expected that NDS will present a paper on the IAEA programme on A+M data for fusion.

B.2.7 IAEA Advisory Group Meeting on Fission Product Nuclear Data (FPND), Petten, 5-9 September 1977

The IAEA Advisory Group Meeting on Fission Product Nuclear Data (FPND) which will be convened at the Energy Research Foundation, Petten, Netherlands, 5-9 September 1977, is a follow-up to the Panel on FPND, held in Bologna, Italy, in 1973. Its purpose is to review the progress in the field of FPND since the Bologna Panel, and to specify the requirements for more accurate FPND in the various application fields.

The following data types are to be covered at this meeting:

- fission product yields;
- fission product neutron cross sections;
- fission product decay data; and
- delayed neutron data.

The basis for discussions will be provided by 15 comprehensive review papers which will review the international status of knowledge and experience in the fields to be covered at the meeting. The titles of the proposed review papers and the names of their prospective authors are given in Appendix 19.

B.2.8 IAEA Advisory Group Meeting on Nuclear Structure and Decay Data, Oak Ridge National Laboratory, 14-18 November 1977

The objective of the next meeting on nuclear structure and decay data will be to consolidate the initial agreements reached at the May 1976 Meeting (see sections B.1.10 and D.2.1).

B.3. Meetings planned for 1978

The following meetings are planned to be sponsored or attended by the Nuclear Data Section.

- Winter Courses on Nuclear Physics and Reactors, ICTP Trieste, January-March 1978	Coordinated within IAEA and partially sponsored by NDS
- Consultants' Meeting on Integral Cross Section Measurements in Standard Neutron Fields for Reactor Dosimetry, Vienna, 1978	NDS-sponsored
- Annual Meeting of the Nuclear Reaction Data Centres NDCC, Saclay, Spring 1978	NDS-sponsored
- Advisory Group Meeting on Nuclear Data for Fusion Research and Technology	NDS-sponsored
- Advisory Group Meeting on Isotope Nuclear Data Requirements in Science and Technology (Second half of 1978)	NDS-sponsored
- Consultants' Meeting of the Nuclear Structure and Decay Data Centres, Mid 1978	NDS-sponsored
- Training Course for Evaluators of Mass Chain Nuclear Structure Data, Mid 1978	NDS-sponsored
- Conference on Neutron Physics and Nuclear Data for Fission Reactors and Other Applications, organised jointly by NEA and UKAEA, Harwell, 25-29 September 1978	NDS (cooperation)
- Third Meeting of the Joint IFRC/INDC Subcommittee on A+M Data for Fusion Sept/Oct 1978	NDS-sponsored
- Tenth Meeting of INDC, October 1978	NDS-sponsored
- Advisory Group Meeting on A+M Data for Fusion Research and Technology (Second half of 1978)	NDS-sponsored

C. COORDINATING AND EVALUATION ACTIVITIES

C.1. WRENDA

WRENDA 76/77 was published as document INDC(SEC)-55/URSF in August 1976. It contains the data request lists for three fields of application:

1. fission reactor development
2. fusion research and reactor development, and
3. nuclear safeguards development.

The fission request list contains 1194 data requests from 19 Member States and one international organization; the fusion list, 328 requests from six Member States; and the safeguards list, 150 requests from 6 Member States.

The following changes have been made in the WRENDA operation and publication as a result of recommendations made at the 8th INDC Meeting:

- WRENDA is to be published every 2 years instead of annually. The next edition, WRENDA 78/79, will be published in 1978.

- Requests unreviewed for 2 years were automatically dropped in WRENDA 76/77.

- Old status comments were deleted, NDS provided new status comments in WRENDA 76/77 using reports of the technical INDC and NEANDC subcommittees as guidelines.

- The word measurements was dropped from the WRENDA document title.

In addition, the following programming changes were made to the WRENDA system:

- In the printed book the "request number" is now printed on the right-hand side of the page, and a "serial number" on the left-hand side. This serial number starts at 1 with the first fission request and continues through to the last safeguards request.

- A file has been created which contains the serial-number/request-number cross-reference for each book-production.

- In future editions of WRENDA, the cross-reference file from the previous book will be used to print in the list of withdrawn requests, the serial number at the beginning of each line.

C.2. Targets and Samples: Programme Status

In 1972 through 1976 the IAEA has supported a programme to supply targets and samples for neutron nuclear data measurements to developing countries. Upon recommendation of the International Nuclear Data Committee, the IAEA has budgeted about $ 30 000 for support of this programme in 1977. Members of the INDC, INDC Liaison Officers, and IAEA Resident Representatives to developing countries have assisted in disseminating information about this programme to scientists and government officials in their countries.

Decisions to award contracts of targets and samples to developing countries are based on four criteria:

1. Priorities in WRENDA
2. Feasibility of experiment
3. Availability of materials
4. Available funds

Targets and samples ordered during 1976 are listed in Table 1.

In 1976, a research group at the Institute "Josef Stefan" in Ljubljana Yugoslavia, completed measurements with targets obtained through the IAEA targets and samples programme. Their results have been published as INDC report INDC(YUG)-5/L "Measurements of 14 MeV Neutrons Radiative Capture γ-ray Spectra and Integrated Cross Sections in Sc,Y,Pr and Ho." In Romania, a research group at the Institute for Atomic Physics, Bucarest, completed work on "Thermal Neutron Scattering Law of Na and NaK at Various Temperatures" with the help of targets received through NDS. A preprint of the report and results in the form of a computer print out have been received.

The targets of pure isotopes of Sc, Y, Pr and Ho in the form of spheres canned in Al foil, have been returned to the IAEA by the Yugoslav group and are now available for loan to other interested research groups. Similarly targets of natural isotopic composition (99% pure) Zr, Hf, Nb and Mo, which were ordered for Greece, are also available through the targets and samples programme.

Table 1. Orders of targets and samples during 1976

Requestor	Requested Samples	Purpose	Application	Cost
Bangladesh	Fertile, fissile and other actinide nuclide samples	Fission cross section and fission systematics measurements	1. Fission reactors 2. Reactor neutron dosimetry	$ 6,800
Yugoslavia	LiF and LiH samples + Tritium targets	Neutron elastic and inelastic scattering measurements on lithium isotopes	1. Standards for nuclear data measurements 2. Fusion reactor blanket	$ 2,100
Romania	Ba and Gd isotope samples	Measurements of energy and angular distributions of neutrons in (α,n) reactions for the determination of statistical parameters needed in fast neutron cross section calculations	Study of neutron nuclear reaction mechanism	$ 6,400
Romania	U samples of various enrichments	Measurement of absolute yield of delayed gamma rays emitted in photofission of enriched uranium	Safeguards methods development	$ 2,600
Pakistan	Samples of various higher Pu and other actinide isotopes	Fission measurements	1. Effect of actinide fission in fission reactors 2. Systematics of fission mechanism	$ 7,900
Pakistan	Nd-150	Measurement of γ-ray spectrum following neutron capture	Nuclear Level spectroscopy	$ 6,800

C.3. Reactor Dosimetry Data

C.3.1 IAEA Programme on Benchmark Neutron Fields Applications for Reactor Dosimetry

This programme which was initiated by IAEA/NDS has the following objectives:

- to investigate the availability of neutron fields which can be used as benchmarks for reactor neutron dosimetry;
- to review the current status of differential and integral data, to test their consistency and to indicate areas of discrepancies;
- to remove inconsistencies between integral measurements and evaluations of differential data in order to arrive at internationally recommended internally consistent sets of neutron data for reactor dosimetry;
- to establish standard procedures in the use of benchmark neutron fields, and in general to improve the knowledge of reference fields and reaction cross sections.

The following two steps towards fulfilling these objectives have been undertaken so far:

- a questionnaire to assess the existence and obtain the specifications of neutron fields was sent out to Member States and the answers to this questionnaire have been analyzed. A preliminary summary of this survey was presented at the November 1976 Consultants Meeting on Integral Cross Section Measurements in Standard Neutron Fields (see section B.1.17).
- IAEA/NDS convened this meeting with the main objectives to discuss the status of reactor dosimetry neutron data, of spectral characterization of benchmark neutron fields, and the validation of differential cross sections on the basis of integral data. This meeting is summarized in report INDC (NDS)- 81.

C.3.2 Participation in the IAEA Programme on Standardization of Reactor Radiation Measurements

The main objective of this programme is to provide standard operating procedures for reactor laboratories (including developing countries) to measure neutron reactor fluence and spectra by the multiple foil activation technique. To determine the neutron spectrum by this method, the following steps have to be performed:

- the intercomparison of available computer programmes for spectrum unfolding, and the recommendation of one of these codes for general use;
- the preparation of a recommended energy-dependent neutron activation cross section set; and
- the determination of saturation activities of irradiated detector foils.

During the reporting period, NDS has

- reviewed the quality of neutron cross section data to be used for neutron spectrum unfolding;
- tested sets of available differential cross section data (e.g. ENDF/B, SAND-2, etc.) by comparing calculated spectrum averaged cross sections (using the DETAN-74 computer code) with available integral measurements;
- converted point-wise evaluated data of the ENDF/B-IV dosimetry file for twelve reactions (selected for spectrum unfolding) into 620 group presentation for use with the SAND-2 unfolding programme;
- produced a preliminary evaluation of the Ti-48 (n,p) reaction cross section and converted it in multigroup form suitable for use with the SAND-2 programme; and
- performed an analysis of responses to the neutron reactor dosimetry questionnaire regarding the use of different reactions for neutron fluence and spectrum determination by activation technique. The compilation and critical review of most often used reaction data (^{58}Ni(n,p), ^{54}Fe(n,p) and several other reactions) has been initiated on the basis of the questionnaire response.

C.3.3 Review of the Excitation Functions of Energy-dependent Neutron Induced Reaction for Dosimetry Applications

A review report on the "Status of Neutron Cross Sections for Reactor Dosimatry" has been written by M. Vlasov (NDS) together with A. Fabry and W.M. McElroy, and reported at the 1976 Lowell Conference (see section B.1.11), and has also been distributed in report INDC(NDS)-84/L.

Another review report on the status of differential data for reactor dosimetry, which will include other reactions not covered by the Lowell paper, is in preparation and will be presented at the Second ASTM-Euratom Symposium on Reactor Dosimetry (USA, October 1977).

C.4. Fission Product Nuclear Data (FPND) Report Series

Two issues of the report series "Progress in Fission Product Nuclear Data" have been published by NDS, the first in November 1975 and the second in May 1976. 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.

Each report consists of reproductions of original contributions which the authors send to IAEA/NDS. The contributions contain in general concise information about the type of experiment or compilation/evaluation performed or planned, the methods applied, and references to published literature; results and data are usually not included.

The publication cycle has been altered from 6 months to one year, in order to keep more adequate pace with the progress in programmes and experiments. The 3rd issue is therefore envisaged to be published in May 1977.

C.5. 2200 m/s and Thermal Maxwellian Neutron Data of the Fissile Nuclides

Since the 1975 Washington Conference on Nuclear Cross Sections and Technology, where H.D. Lemmel presented a paper on the "Third IAEA Evaluation" of the thermal fission data, only few important new results have been obtained in this field.

The most essential item is that a number of experiments (not yet published) have confirmed the low value of the Pu-239 half-life (around 24 080 $\pm$ 50 years), first measured by Oetting, which is almost 2% smaller than the previously accepted values. This lower half-life value raises the value of the Pu-239 fission cross-section, and improves the consistency of the Pu-239 data.

In contrast to this, the discrepancies between the 2200 m/s and Maxwellian spectrum average fission cross-sections continue to exist for U-233 and U-235. B.R. Leonard has produced an improved least-squares fitting method for U-235 by fitting not only the 0.0253 eV and Maxwellian average data, but simultaneously taking into account the entire cross-section curves in the thermal energy range. Inspite of this improvement the results continue to show the same discrepancies.

A number of confirmatory fission-neutron yield data measurements are going on, but no results have been obtained which differ from the 1975 evaluation values. Only few additional experiments have been reported (e.g. a nu-bar measurement in USSR), but their accuracies are not sufficient to have significant influence on the simultaneous least-squares fit of all data.

H.D. Lemmel was invited to give a paper on this topic at the Gaithersburg Symposium on Neutron Standards and Applications, 28 March - 1 April 1977 (see above item B.2.1), but was not able to attend.

C.6. Evaluation of Actinide Neutron Data

A Consultants Meeting on the Evaluation of Actinide Neutron Cross Sections was convened in Vienna on 13-14 December 1976 to investigate the feasibility of a coordinated evaluation programme. A summary of this meeting is given in section B.1.18.

The meeting concluded that a complete evaluation of neutron nuclear data for one isotope should cover all occuring neutron reactions for thermal neutron energies, resolved and unresolved neutron resonances, and fast neutron energies, and include

1. a full list of references;
2. a description of the evaluation methods used;
3. a discussion of the uncertainties of the evaluated data; and
4. a comparison with other recent and/or widely available evaluations.

The consultants emphasized that the required accuracies vary with the application. The first source of references for the required accuracies should be the report IAEA-186 in which special attention was given to accuracy. Since accuracies were not in general considered as carefully for WRENDA, the accuracies listed in WRENDA 76/77 (INDC(SEC)-55/URSF) should only be used when they are not available in IAEA-186.

The consultants agreed in principle on the usefulness of a coordinated evaluation programme and recommended that, for such a programme to be successful, the IAEA should devote more effort and funds for this purpose and in particular should

1. conclude research contracts and agreements with the participants in the programme;
2. provide experimental and evaluated data available at the IAEA in the format in which they were received;
3. sponsor research coordination meetings between the programme participants; and
4. distribute the results of evaluations performed as part of the coordinated programme.

The following 14 nuclei were identified as being the most important:

^{241}Am, ^{242m}Am, ^{243}Am, ^{242}Cm, ^{244}Cm, ^{245}Cm, ^{246}Cm, ^{247}Cm, ^{248}Cm, ^{249}Bk, ^{249}Cf, ^{250}Cf, ^{251}Cf, and ^{252}Cf.

It was agreed that a statement of every country's intention for participation in a coordinated evaluation programme with changes to the proposed list (thereby implying results of bilateral agreements) be sent to the IAEA by 31 March 1977. IAEA/NDS will include these statements in the minutes of this meeting and distribute them as an INDC report. In due course, after March 77, the IAEA will be expected to conclude research contracts and agreements respectively with the programme participants. Each of the participating groups should then inform the others every six months about the progress of its work.

Provided that a coordinated research programme on the evaluation of actinide neutron cross sections can be worked out in the first months of 1977, it was agreed that the next meeting on this subject be held in January 1978.

C.7. Measurement of Actinide Nuclear Decay Data

The most important conclusion of the Transactinium Isotope Nuclear Data (TND) meeting which was held in November 1975 at Karlsruhe, consisted in the recommendation that "... an internationally coordinated effort be implemented and pursued during the next ten years so as to improve the status of TND required for nuclear technology".

As it was recognized that the presently available accuracies of half-lives, and alpha and gamma-ray intensities of a number of transactinium nuclides need to be improved to fulfil the needs for reactor analysis

materials safeguards, mass determination and the preparation of standards, the meeting recommended that an international cooperative research project be coordinated by the IAEA for the measurement and evaluation of needed decay data of transactinium nuclides. In order to arrive at an accurate and world-wide consistent sets of these data, it was suggested that this coordinated project comprise the measurement of needed data, evaluation of existing data, intercomparison between laboratories concerned, and the exchange of samples and techniques.

In compliance with this recommendation, the IAEA/NDS plans to start the preparation for this cooperative research project in the course of 1977.

D. DATA CENTRE ACTIVITIES

D.1. Nuclear Reaction Data

D.1.1 Neutron Data

CINDA coverage

The coverage of the current literature for CINDA seems to be fairly complete in the sense that all important journals, laboratory reports, conference proceedings, etc. are regularly scanned by CINDA-indexers (memo 4C-2/82 and 4C-3/191). In addition, INIS retrievals are used for completeness checks and for finding CINDA relevant information in the large number of less important publications not regularly scanned by CINDA-indexers.

NDCC/Saclay is programming a computerized coverage control system, which had not been existing since the CINDA computer programme conversion performed at Saclay a few years ago (see memo 4C-2/75a).

In 1975/76 NNCSC had conducted a questionnaire survey about the new features introduced in CINDA, with particular reference to

- the blocking of all references referring to the same experiment, and
- the adding of the relevant EXFOR accession numbers.

Although these features had not yet been implemented consistently, the questionnaire returned showed a large majority to be in favour of these features.

At all centres the clean-up of CINDA continues, i.e. to improve the blocking, to discover and eliminate gaps, to remove duplicates, to remove from the book (though not from the file) superseded references, etc. This activity is scheduled such that the file should be clean at the time of the 1978 CINDA publication. This clean-up work has required and will still require continuous coordination and consultation between the centres and their CINDA-indexers.

CINDA publication

As an intermediate solution of the problem of increasing paperwork and cost, a two years' publication cycle was initiated with the publication of CINDA 76/77. The cumulative CINDA 76/77 (2 volumes, 1000 pages each) and its first supplement ($\sim$ 200 pages) have been published and distributed on schedule. Two further supplements (approximate sizes about 400 and 600 pages respectively) will be issued in June and December 1977 respectively.

The question whether, how, and at which "cut-off-date" the 1978 CINDA publication shall be split into an "archival" and a "current" volume, is still being discussed among the four centres (memos 4C-1/102, 4C-2/83 and 4C-3/188).

A possible publication schedule may be as follows:

spring 1978:	"archival issue" in 2 vols of ca. 1000 pages each containing references up to date x plus a third volume containing the references since date x
fall 1978:	supplement
spring 1979:	cumulative issue with all new entries since date x
fall 1979:	supplement
spring 1980:	cumulative issue with all new entries since date x
fall 1981:	supplement etc.

The optimum choice of date x which is likely to lie within the period 1974-77 will still have to be discussed.

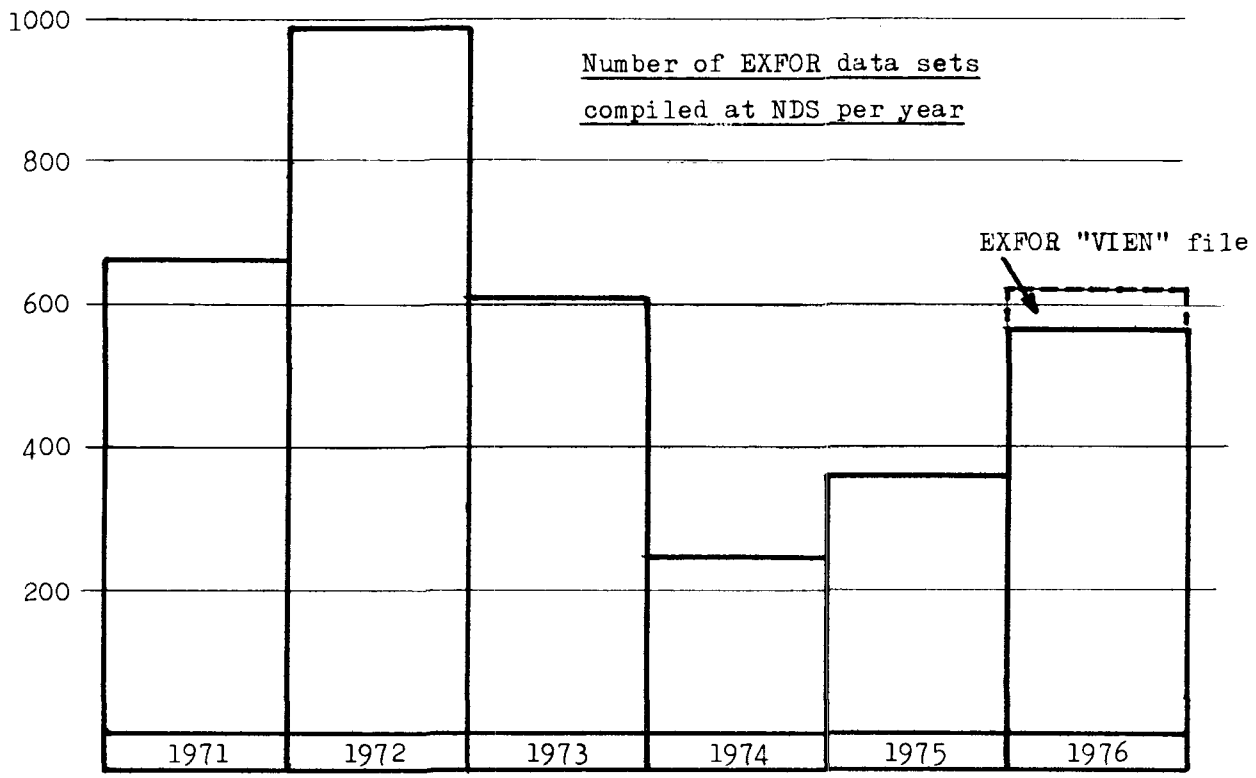
EXFOR Compilation

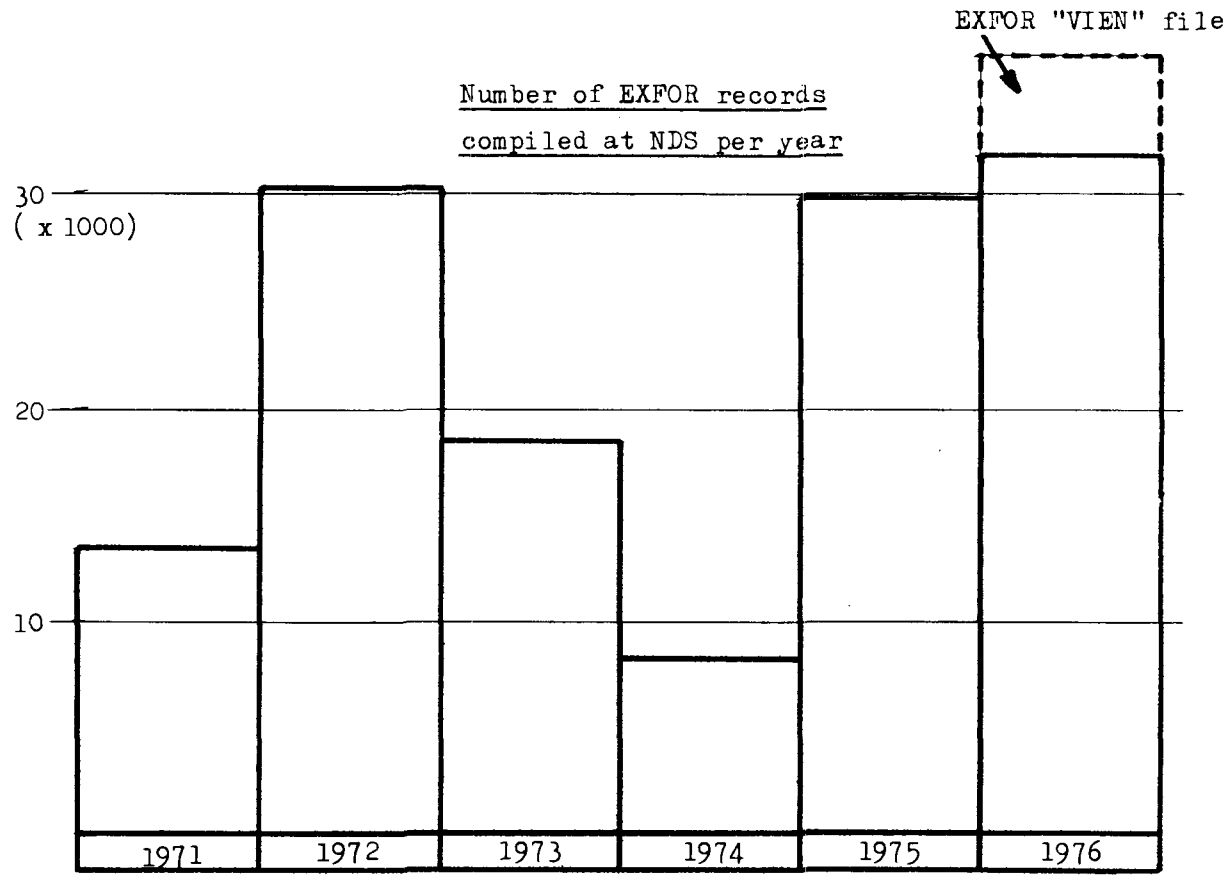
The compilation of experimental neutron nuclear data in EXFOR continued. The measurement of neutron nuclear data in countries in the NDS service area shows a slightly increasing (rather than a decreasing) tendency. Countries where neutron data have been measured, which were received at NDS for the first time during 1976, are Thailand, New Zealand, and Bulgaria.

Figure 1 shows the development of the EXFOR compilation work at NDS during the years since 1970, the date of the EXFOR agreement. The fluctuations do not only reflect the volume of data measured in the NDS service area, but also the fluctuations of NDS staff. The small amount of data compiled in 1974 was due to vacant posts at that time and due to the consequent loss of continuity. The significant backlog of data to be compiled from this period could meanwhile be reduced only slightly.

The total content of the EXFOR Library as of 1 January 1977 is about 16 000 data sets comprizing more than $1.5.10^6$ individual data records. The contributions from the countries of the NDS service area amount to about one sixth of the total data sets in EXFOR. It is worth noting

Figure 1


Number of EXFOR data sets
compiled at NDS per year
EXFOR "VIEN" file
1000
800
600
400
200
1971
1972
1973
1974
1975
1976


EXFOR "VIEN" file
Number of EXFOR records
compiled at NDS per year
30
(x 1000)
20
10
1971
1972
1973
1974
1975
1976

that the "official" EXFOR Library is supplemented with a "semi-official" library produced at NNCSC which comprizes the old SCISRS Library converted into EXFOR format. Both libraries together probably contain most of the experimental neutron nuclear data.

When starting to compile charged-particle nuclear data into EXFOR, a number of new features and additional coding rules had to be added to the EXFOR system, involving several additional branches to be added to the EXFOR computer programmes. The resulting "Generalized EXFOR System" can now incorporate all types of nuclear reaction data and will also be suitable for atomic, ionic and molecular reaction data. The gradual transition of EXFOR operations to the generalized system is presently being implemented at the neutron data centres.

The EXFOR "VIEN" File

For several years NDS has been concerned that some important existing evaluated data are incorporated in one of the established Evaluated Data Libraries only with several years' delay. Although they may be of great importance to data requestors, such evaluations have generally not been available from computer retrievals at the data centres.

NDS has therefore started to compile such evaluated data in EXFOR format, in the so-called "VIEN" ("Various International Evaluated Nuclear") data file. A typical example of data included in this file is a library of neutron reactions for neutron dosimetry from Riga, USSR, which is not yet available in SOKRATOR or any other standard format.

This file shall certainly not be a competitor to the established evaluated data libraries, but simply serves as a convenient storage and retrieval medium for such data using existing EXFOR computer programmes. The fact that these data have been repeatedly requested and disseminated, shows the need for such a file.

Workload and size of this file, as compared to the EXFOR Library, is shown in Figure 1.

Evaluated Data Libraries and Other Libraries at NDS

A summary of data libraries available at NDS can best be gleaned from the following extract of the Table of Contents of the NDS nuclear data catalogue "CINDU-11". For all libraries except EXFOR, NDS does not serve as a compilation centre but only as a distribution centre. For the major data libraries, that is EXFOR, ENDF/B, UKNDL, KEDAK and SOKRATOR, NDS can provide specific retrievals mostly in two formats, standard format for computation purposes and edited format for easy readability. For the other libraries, NDS provides only entire tape copies.

Extract from the Table of Contents of CINDU-11

Neutron nuclear data, experimental

EXFOR, the main international library for experimental neutron nuclear data. It includes most of the data compiled earlier in SCISRS (NNCSC), NEUDADA (NDCC), or DASTAR (IAEA/NDS).

The Livermore Library ECSIL.

The Musgrove Library of strength-function data (Australia).

The Crouch Library of experimental fission-product yield data (UK).

DASTAR, containing only a few data sets not yet converted to the EXFOR format.

Neutron nuclear data, evaluated

General evaluations

ENDF/B-4, seven standard nuclides

UKNDL

KEDAK

SOKRATOR (USSR)

DASTAR including some earlier USSR evaluations

The Livermore Library ENDL

French evaluations in ENDF/B format

NDS evaluations for fissile nuclides

(n,2n) cross-sections at 14 MeV

Dosimetry reactions

ENDF/B-4, dosimetry file

UKNDL, dosimetry file

The Livermore Library ENDL, dosimetry file

The Riga dosimetry file

SAND-2 and DETAN-74

Romanian evaluations

The Budapest dosimetry file

Fission-product data

The Australian Library of evaluated neutron cross-sections for fission-product nuclei:
- point data
- group data

(supersedes the fission-product part of the UKNDL DFN 701-778)

The Bologna Library of evaluated neutron cross-sections for fission-product nuclei.

The ENDF/B Library for fission-product cross-sections (and decay data).

The Devillers Library of fission-product yield (and decay data).

The Japanese Library for fission product cross-sections.

Group constants

ARAMACO - USSR group constants

Photonuclear data

NNCSC/LLL Library of experimental photo-neutron data

Charged-particle nuclear data

The Karlsruhe Library of experimental charged-particle nuclear cross-section data.

ENDF/B Starter Library of evaluated charged-particle nuclear cross-section data.

Nuclear structure and decay data

ENDF/B Library of evaluated fission-product decay data.

The Devillers Library of evaluated fission-product yield and decay data.

The Decay Data Subfile of the Evaluated Nuclear Structure Data File (ENSDF) of the Oak Ridge Nuclear Data Project.

The Juelich Library for gamma-lines of radionuclides.

Note: Spontaneous fission yield data are included in the EXFOR Library of experimental neutron data.

D.1.2 Charged Particle Nuclear Data (CPND)

Development of the CPND Centre Network

Consultants' Meetings of representatives of CPND centres and groups are being held annually in connection with the long-established annual meetings of the Four NND Centres. See Appendix 5 for the list of co-operating CPND centres and groups.

A communication network for the exchange of data and information between all cooperating CPND centres and groups has been established and is co-ordinated by NDS. It comprises the organized inter-centre exchange of:

- memoranda for discussions on the further development of the cooperation and compilation rules;
- a generalized EXFOR Manual containing the agreed rules for the compilation of all nuclear reaction data;
- the EXFOR Dictionaries for agreed keywords and abbreviations; and
- the EXFOR data tapes.

The Generalized EXFOR System

The EXFOR system, originally developed for the exchange of neutron data, has proven to be suitable for nuclear reaction data in general. The main difference between the existing EXFOR system (designed for neutron reaction data) and a generalized EXFOR system (e.g. for all reaction data including charged particle or atomic reaction data) is in the definition of the required reaction identifiers and in the introduction of new generalized identifiers pertinent to the specific field of physics describing the experiment and the data.

The development of the generalized EXFOR system has progressed to the point where several EXFOR computer programmes at NDS, and at other centres, can handle both neutron data and CPND EXFOR entries.

Compilation of Integral CPND

Compilation of integral cross-sections and thick-target yields is primarily done at KACHAPAG, Karlsruhe, Germany (Fed. Rep.) and at CAJaD, Kurchatov Institute, Moscow, USSR. NNCSC will assist in the compilation of unpublished US data; NDS cannot accept a commitment for CPND compilation, but has compiled some CPND data in those cases where NND and

CPND were reported in the same paper. A master library of integral CPND compiled in EXFOR format is maintained at KACHAPAG. Copies of this library are sent periodically to the distribution centres. Although the KACHAPAG CPND EXFOR library is still small, the compilation of integral CPND in EXFOR format is in operation.

Compilation of Differential CPND

The compilation of differential CPND is a more complex matter. The practical applications of differential CPND are not as straightforward as those for integral CPND, although certain specific categories of differential CPND are regarded as quite important for specific purposes. Thus, a number of groups and individuals in various countries have been compiling differential CPND for rather specialized applications. It has been recommended that such compilations, wherever they exist, should be entered in EXFOR format, in order to facilitate the international exchange of these data.

Primarily because of its active interest in data for basic nuclear science, the only centre which has submitted trial EXFOR entries for differential CPND, is the Tokyo Institute of Technology.

Other active groups exist in

- UK (emphasis: secondary energy distributions needed for surface investigations);
- India (emphasis: differential (α,d) and (α,p) stripping cross-sections and polarizations); and
- Poland (emphasis: cross-sections and gamma-intensities and energies from (p,γ) reactions).

It is hoped that these groups will receive the support to issue their compilations in EXFOR format, and that other groups will join the network.

CPND Bibliographic Index

A bibliographic index for integral CPND is being created by NNCSC, USA. After careful analysis it was found that none of the existing bibliographies (Recent References, INIS, etc.) offered the required retrieval capabilities so as to separate integral from differential CPND. Thus, a new bibliographic index file for integral CPND had to be created. Its

format and data organization will be modelled on the CINDA index. A printed issue is expected not to exceed the size of a CINDA Supplement (ca. 200 pages). "Recent References"* is to be used as the index for differential CPND.

Dissemination of CPND

The distribution and customer services for CPND will be performed by the Four Neutron Data Centres as they have already developed the required facilities for indexing, retrieving, format conversions, etc. In addition, the ZAED, Karlsruhe, plans to act as a distribution centre for the Fed. Rep. of Germany.

D.2. Nuclear Structure and Decay Data

The international effort in this field is concerned with two specific aspects: the establishment of a world-wide coordinated mass-chain evaluation effort, and the maintenance of a network of data centres for the free exchange and dissemination of nuclear structure and decay (NSD) data.

The functions of IAEA/NDS in this field of nuclear data, as recommended by the May 1974 NSDD meeting (INDC(NDS)-60) and the May 1976 NSDD meeting (INDC(NDS)-79 (see also section B.1.10)) are:

- to function as the international coordinating centre for the NSD data centre network, and
- to maintain a referral service for NSDD.

In addition to these coordinating functions, NDS reviews the requirements for NSDD of importance to application of radiations and isotopes, and provides data centre services to NSDD users.

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* Bibliographic data storage and retrieval system developed and operated by the Nuclear Data Project at the Oak Ridge National Laboratory in the US. Output from this system has been published periodically in the Nuclear Data Sheets journal.

D.2.1 NSDD Centre Network Coordination

NDS coordination of the world-wide effort to compile, evaluate and disseminate NSD data, consists primarily in convening meetings of representatives of the NSDD centre network.

- The last meeting, convened with the objective to form the international NSDD centre network and to organize international contribution to the mass-chain evaluation effort, was held in May 1976 (see section B.1.10).

- The objective of the next meeting on nuclear structure and decay data, planned to be held at the Oak Ridge National Laboratory in November 1977, will be to consolidate the initial agreements reached at the May 1976 meeting (see section B.1.10) with particular emphasis on the organization of the international effort for the compilation and evaluation of mass-chain nuclear structure and decay data.

- A smaller meeting convening primarily representatives of data centres concerned with the compilation and dissemination of nuclear structure and decay (NSD) data is planned to be held in 1978. The primary emphasis of this meeting will be to inquire into the progress of cooperation and the user services of NSD data distribution centres.

- A one-week training course for the training of evaluators of mass-chain nuclear structure data has been proposed to be held in 1978. This course will be designed to instruct the new participating evaluators of mass-chain nuclear structure data, particularly from developing countries, in the methodology and rules of mass-chain evaluation so as to guarantee the maintenance of their established standard of quality.

D.2.2 NSD Data Referral Service

In context of its function as central information office for NSD data, NDS maintains and publishes semi-annually a compilation of published and to-be-published compilations and evaluations of nuclear structure and decay data.

This periodically issued report is designed to keep the nuclear scientific community informed of the availability of compiled or evaluated NSD data. It contains references to laboratory reports, journal articles and books containing selected compilations and evaluations, but excludes references to "mass-chain" evaluations normally published in the "Nuclear Data Sheets" and "Nuclear Physics".

The material contained in this compilation is sorted according to eight subject categories:

1. General Compilations
2. Basic Isotopic Properties
3. Nuclear Structure Properties
4. Nuclear Decay Processes: Half-lives, Energies and Spectra
5. Nuclear Decay Processes: Gamma-rays
6. Nuclear Decay Processes: Fission products
7. Nuclear Decay Processes: (Others)
8. Atomic Processes.

The first issue of this compilation was distributed in September 1976 as report INDC(NDS)-80/LN. The second issue is due to be published in April 1977 as report INDC(NDS)-83/LN.

D.2.3 NSD Data Service

NDS does not perform any systematic compilation of NSD data, but maintains up-to-date libraries of published and computerized NSD data compilations. Because of limited manpower, NDS has been able to answer only a fraction of the requests received for NSD data, and a number of recommendations from IAEA meetings to provide selected recommended data for given applications have not been able to be followed up. Most requests have been for recommended half-lives, of which there is no current, up-to-date, easy to refer compilation.

The following list consists of NSD data requests part of which NDS has not been able to fulfil:

1. Recommendation from Consultants' Meeting on Nuclear Data for Reactor Neutron Dosimetry (Vienna, September 1973) for IAEA/NDS to provide evaluated NSD data, including half-lives and decay schemes of relevant radionuclides which are of importance to reactor dosimetry measurements, and to keep this evaluation current.

2. Recommendations from the IAEA Panel on Fission Product Nuclear Data (November 1973) include a large number of requests for NSD data for fission products. (See INDC(NDS)-65, pp. 248-249, 263-264).

3. Recommendations from Panel on Hot Atom Chemistry (Vienna, May 1974) indicated the lack or inadequacy of certain NSD data (decay schemes, tabulations of internal conversion coefficients, etc.) and requested IAEA/NDS to provide these data.

4. Request by the IAEA's Safeguards Division of Development to provide recommended mass data and half-life values for uranium and plutonium isotopes, for the Agency's Process Analysis Field Experiment II (PATEX II) for Safeguards analytical services (June 1975).

5. Recommendation from the IAEA Advisory Group Meeting on Transactinium Isotope Nuclear Data (November 1975) (INDC (NDS)-74): page 26) lists the requirements for a number of half-life data.

6. Request by the IAEA Division of Life Sciences, (January 76) for half-lives, abundances, and activation cross sections required for the programme on nuclear methods in research of non-radioactive pollutants.

7. Request from Debrecen, Hungary (November 1976) for a listing of half-life values for all isotopes and isomers.

D.3. Atomic and Molecular (A+M) Data

D.3.1 Programme Status

The NDS programme on A+M data for fusion has been approved by the governing organs of the IAEA in 1976 and has been implemented for a trial period of two years (1977-1978). During this period the programme will be reviewed by the Joint IFRC/INDC-Subcommittee on A+M Data; at the end of this initial two-year period the Subcommittee is to recommend to the Director General of the IAEA whether the trial programme should be converted to a continuing programme after 1978. (See section B.1.16).

The new A+M data unit of IAEA/NDS has been staffed with three professionals: one P-4 physicist to head the programme, one P-3 physicist to assist in executing the programme and a P-3 programmer responsible for the programming needs; all three have been hired starting in 1977 for two years on special service agreements. To assist in the execution of the A+M data programme, one data preparation clerk and one secretary have also been hired.

D.3.2 Programme Scope and Objectives

Following the recommendations of the IFRC/INDC Subcommittee on A+M data at its first meeting in November 1976, the initial tasks of the A+M data unit will be as follows:

- creation and publication of an international index of references to atomic collision data;

- compilation, publication and distribution of a quarterly bulletin on newly measured or calculated fusion-related A+M data and associated information; and

- formulation of a common system for the exchange of bibliographic and numerical A+M data between centres.

The scope of A+M data considered will consist of three data categories:

- atomic collision data
- atomic structure data
- surface interaction data

Emphasis will be given to those data which have been identified by the Advisory Group Meeting on A+M Data for Fusion, Culham, November 1976 (see section B.1.15) to be of most importance to current fusion research. A thorough review of all three categories of A+M data required for fusion is given in the three Working Group Reports included in the Summary Report of the November 1976 Culham Meeting (INDC(NDS)-82/GB).

D.3.3 International Cooperation

A+M Data Centre Network

To aid IAEA/NDS in accomplishing these tasks and objectives, an international network of A+M data centres has been formed. The cooperation between these centres will be coordinated by the A+M data unit of NDS. The centres which will initially form part of this network are listed in Appendix 18. The objectives of the centres' cooperative activity is to set up common operational procedures for the world-wide compilation, evaluation, exchange and dissemination of bibliographic and numerical A+M data required by the fusion community. The first meeting of this network will take place 9-13 May 1976 in Vienna (see section B.2.4).

A+M Liaison Officer Network

Also, in order to provide an efficient channel of communication between the various data producing and data using research groups, IAEA will form a network of liaison officers in all Member States concerned, so as to provide a link for the exchange of information between national centres, the IAEA/NDS, and the research laboratories. This network should also be functional for the coordination of experimental and theoretical research aimed at the determination of A+M data for fusion in different countries.

These liaison officers should be key people in key national establishments or data centres conversant with the data requirements for fusion, and also be experienced in at least one of the basic A+M data fields. Generally, it will be their responsibility to ensure that their national fusion establishments and universities coordinate their A+M activities effectively with the data centre network. Specifically, it will be their responsibility among others, to provide to the IAEA as well as to their national data centres pre-published new data and to identify data needs for inclusion in a bulletin to be published periodically by the IAEA (see section D.3.5 below).

D.3.4 A+M Collision Data Index

One of the first and foremost tasks assigned to IAEA/NDS is the creation of an international computerized index of references to A+M collision data and its publication by the end of 1978.

This index should contain references to all publications on data measurements, calculations, evaluations and reviews of reactions between atoms, molecules, ions, electrons and photons, expressed in terms of cross sections and reaction rates. Excluded from the index would be plasma-solid interactions (except in the few cases where these phenomena give information about single binary collisions) and atomic and molecular structure data, as these data would require a more sophisticated format.

The index should cover the properties of collisions between electrons, photons, atoms and molecules (including ions) in chemical systems composed of either pure hydrogen (including D and T), or of hydrogen (and/or D, T) plus one or two other elements, such as H+Mo or H+CO. The energy domain covered by the index should not be limited, but a simple specification of the energy or energy range of the referenced data should be given as qualitative information in the index.

The format of the index to A+M collision data should integrate as far as possible the formats and information of existing A+M bibliographies, namely those of Dr. C.F. Barnett (US/ORNL), Prof. J.L. Delcroix (FR/Orsay), Dr. E.C. Beaty (US/NBS-JILA) and Prof. K. Takayanagi (JAP/Nagoya) (see Appendix 18) and take advantage of the experience gained by these groups. The experience and the methods used in the development of the CINDA index on neutron reaction data should also be used.

The input to this first index should mainly come from the four centres mentioned above, but other centres, (e.g. USSR/Kurchatov, UK/Belfast, etc.) active in compilation, should also contribute to its input. The contributing centres should be encouraged to computerize their bibliographies using the same format, and send tapes of their files to the IAEA centre.

The index should include references to publications in regular journals, books, review reports, proceedings of major conferences in the A+M data field (i.e. ICPEAC* and ICAP**), and to theses if these are readily available, but not to internal reports which would be covered by the proposed bulletin (see section D.3.5 below).

D.3.5 International Bulletin on A+M Data for Fusion

Following the recommendation of the November 1976 Culham Meeting, NDS has initiated the publication of a quarterly International Bulletin on Atomic and Molecular Data for Fusion. This bulletin is to provide scientists and engineers working on fusion research and technology with recently determined and unpublished A+M data, avoiding the often costly delay between the completion of an investigation and the publication of the results in a report or in the open literature.

The bulletin will be compiled from unaltered original contributions provided directly from investigators or through the network of A+M liaison officers, and will be patterned after the US "Atomic Data for Fusion" newsletter circulated by the ORNL Controlled Fusion Center and the US National Bureau of Standards whose distribution is presently limited primarily to the US laboratories.

The information to be included in this Bulletin consists of measurements and/or calculations and evaluations of data on:

- Electronic structure of atoms and molecules
- Atomic wave functions
- Cross sections for collision processes and interaction of atoms and/or molecules
- Atomic and molecular interactions with radiation
- Atomic and molecular interactions with surfaces.

D.4. Data Centre Services

D.4.1 CINDU-11

In March 1976, CINDU-11, a new "Catalogue of Numerical Nuclear Data available from the IAEA Nuclear Data Section", has been issued. It was distributed to all available addresses within the countries of the NDS service area. Due to this advertisement of NDS activities, but also due to the increasing nuclear power activities in many countries, the number of requests received and of data disseminated has increased significantly.

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* International Conference on the Physics of Electronic and Atomic Collisions.

** International Conference on Atomic Physics.

The previous issue, CINDU-10, had been a detailed CINDA-type data index to all data sets available at NDS. This type of CINDU index has been discontinued, since CINDA acts now as such an index by including the EXFOR accession numbers to specific data sets.

In CINDU-11 emphasis was put on describing and advertising the more than 30 individual data files and libraries now available at NDS (see item D.1.1 above), and a general introduction describes the services provided by NDS. An appendix refers to computer programmes available from the Ispra Computer Programme Library for the more important evaluated data libraries.

D.4.2 Advisory Missions

In order to intensify the contacts with customers of the NDS data centre, and to advertise its services to potential customers, an advisory mission was undertaken in July 1976 by K. Okamoto to nuclear physics institutes and research centres in Poland and in the German Democratic Republic. Both countries have received numerous experimental and evaluated data from NDS. A request for a similar advisory mission was received in 1976 from Romania. Future advisory missions would be useful to a number of other countries which are starting to handle large amounts of nuclear data for energy or non-energy applications.

D.4.3 Data Retrieval Services

Data are provided to customers, according to their requests, as listings, and/or on 7-track tapes with optional densities and blocking factors. In the case of the major data formats (e.g. EXFOR, ENDF/B, UKNDL), data can be provided in the standard format which is usually required for subsequent computer processing, or in an "edited format" in which coded information and data tables are edited in an easily legible format. Whenever data are sent out in any of the standard formats, a brief descriptions of these formats and the coded information is sent with the data. The "Short Guide to EXFOR" is always sent with data in the EXFOR format (see Appendix 20). After a request has been filled, the requestor continues to receive automatically newly acquired data which is of interest to him.

Many data requests require a data analysis, which may consist of a completeness check and/or of a selection of best data where possible. Such services are, however, manpower-intensive, and cannot always be offered to the extent desirable. Certain services have been requested repeatedly by customers but have not been able to be provided systematically (due to lack of manpower); in particular, many requests would require

- conversion of EXFOR data into a "computation format" with uniform units and up-to-date standard values;

- graphical plotting of data, for which the "computation format" is a prerequisite; and

- supply of computer programmes for the handling of EXFOR data tapes.

D.4.4 Statistics

In context of the given statistics a "data set" and a "data request" are defined as follows:

A "data set" comprises a set of data of a given type for a given nuclide in a given energy range, and may contain one single datum or ten-thousand numbers. However, as the EXFOR system evolved the exact definition of a "data set" has varied: in older EXFOR entries a table of double-differential cross-sections had to be entered in several EXFOR subentries (i.e. several "data sets"), whereas the same data table can now be entered in one EXFOR subentry (i.e. one "data set"). Thus, comparisons of "data set" statistics in the course of the last few years exhibit inevitable fluctuations.

A "data request" is in general any single piece of incoming correspondence requesting information (e.g. numerical data or documents), however, when two unrelated items are requested in the same letter, then it is defined as two requests. A data request may range from a small one which can be filled the same day, to large ones which may take up to several man-weeks if it requires scientific analysis and evaluation of requested and available data, or data format conversion to meet the requestor's requirements. Requests also include requests for documents, such as INDC-documents, or data requests which can best be answered by sending a copy of a report.

Figure 2 shows the number of requests received and the number of data sets sent out in the course of the last four years. Currently on the average one request is received each working day.

Figure 2 also shows that the number of data sets sent out per request has increased considerably. Because of the growing size and increased sophistication of data libraries and of incoming requests, the scientific work needed to satisfy a data request has also increased; this situation can be partially alleviated by the concurrent development of more sophisticated computer retrieval programmes.

Figure 3 shows a distribution of requests received according to country of origin and request type. It can be seen that about half of the requests are for documents, and that there is about 1 request per week for experimental data and one request per week for evaluated data.

Figure 2

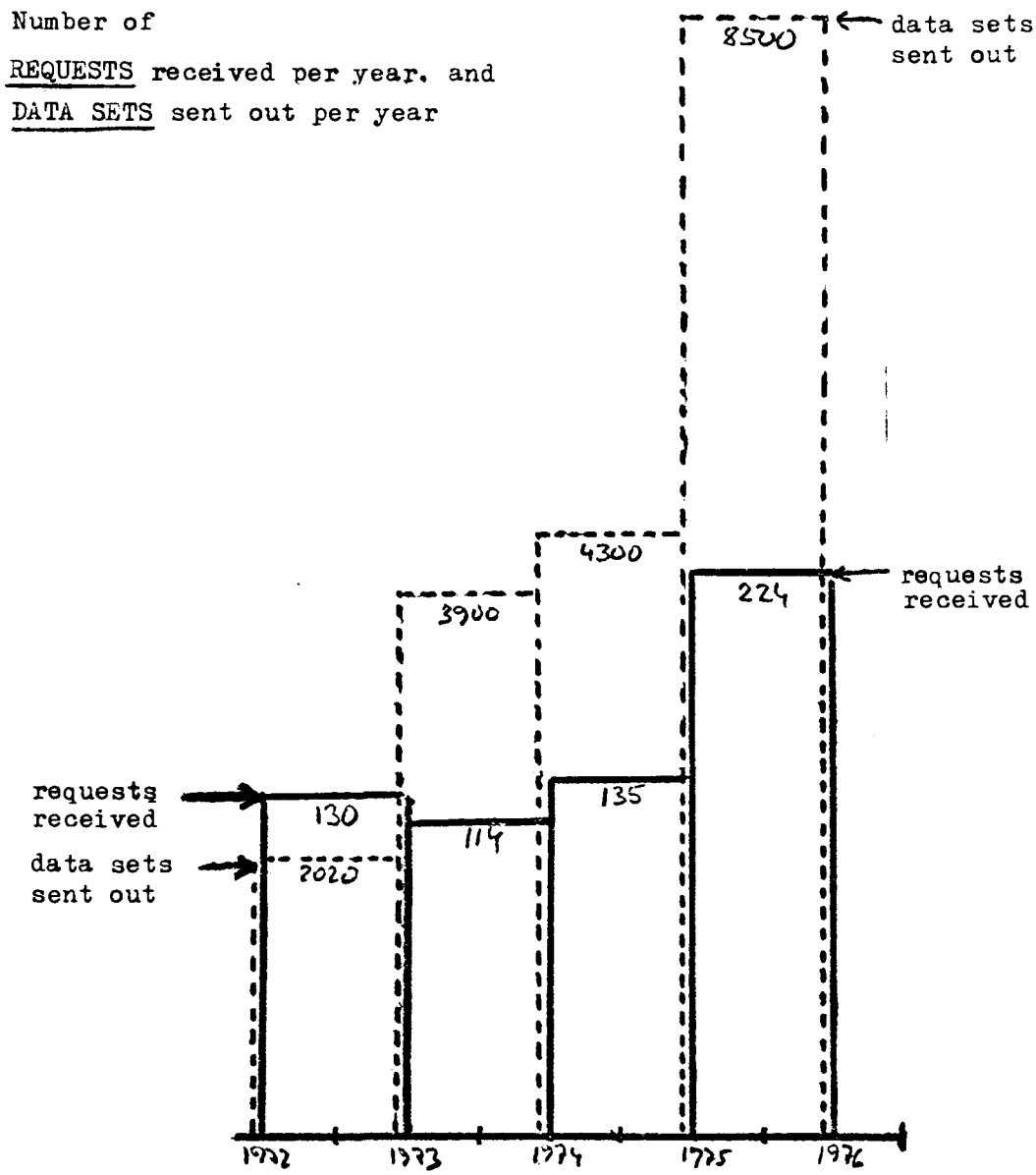

Number of
REQUESTS received per year, and
DATA SETS sent out per year
8500
data sets sent out
4300
3900
224
requests received
requests received
130
119
135
data sets sent out
2020
1972
1973
1974
1975
1976

Figure 3

REQUEST STATISTICS

1 Apr. 1975 - 31 Mar. 1976

AREA 3

Country origin	Experimental	Evaluated	CINDA retrievals	RENDA retrievals	Documents	Total (75)	Total previous year (74)
AREA 1							
NNCSC		3				3	2
USA	1	2			22	25	13
Canada							2
AREA 2							
NDCC	4	3	3			10	16
AUS	2	2			1	5	5
BLG					2	2	1
CCE				1		1	
CER		1				1	
FR					7	7	8
GER	1				16	17	3
ITY					3	3	
NED		1				1	1
SAC							1
SWD	1				1	2	2
SWT					2	2	4
TUK		1			1	2	
UK	1	1			7	9	3
AREA 3							
ARG	1	4			1	6	2
AUL	3					3	2
BAN	3	1			1	5	2
BZL	2				1	3	2
CSR	1	2			6	9	7
DDR	2	3			4	9	8
HKG	1					1	
HUN	2	2	1		1	6	5
IAE	1	1			2	4	1
IND	3	2			12	17	14
ISL	3	4	1	1	5	14	7
KOR					1	1	1
MEX	1				1	2	
PAK	1	1			1	3	
PHI		1				1	
POL	3	4			2	9	4
RUM	1	3			2	6	4
SAF	1	3			1	5	3
UAR	1	1			2	4	2
YUG		1			1	2	4
VEN							1
ISPRA		1				1	
ZZZ	1					1	
AREA 4							
CJD	4	1			2	7	3
CCP	2	2			11	15	1
DUB							1
TOTAL	47	51	5	2	119	224	135

Figure 4 shows the relative importance of the different data libraries held at NDS, although the definition of a "data set" runs into difficulties here due to the different structure of the libraries.

Figure 5 finally shows the relative importance of nuclides and data types (= "ZAQ": Z-number, A-number, quantity) requested from NDS in the period of one year (1 April 1975 - 31 March 1976).

D.5. Programming and Systems Development

D.5.1 General

Great emphasis has been placed on the documentation of all systems, so that routine processing, from the submission of coding forms to the distribution of computer output, is handled by clerical staff. The other advantage of good documentation is that modifications can more easily be made to systems and programmes by staff other than those who originated them.

D.5.2 Data index

The full implementation of the data index has been delayed because of the decision to introduce REACTION coding as used for charged particle data, for neutron data also. A preliminary version of the index, based on the REACTION formalism, is in operation and all files in the EXFOR format have been indexed; these include all neutron and charged particle experimental data, and some evaluated data compiled at NDS. The system will be extended to include additional fields for retrieval purposes and also the standard evaluated data files.

D.5.3 Profile system

The profile system is designed to handle the files of names and addresses of all correspondents of the Nuclear Data Section (currently exceeding 3000) who are on any of the 17 documents distribution lists. The profile system which controls the input, update and output to this file has been completely rewritten to reduce the amount of manual intervention required. New techniques, including programmer team operations and structured programming were used on a trial basis; as a result, these techniques are used for all development work in NDS.

Figure 4

D I S S E M I N A T I O N S T A T I S T I C S

1 Apr. 1975 to 31 Mar. 1976

AREA 3

Data Type	Data Sets*	Amount (previous year)	Data Points	(prev. year)
Experimental (total)	3064	(1690)	303 944	(118.657)
Exfor 1-4 (= regular Exfor)	1892		192 602	
Exfor 5-8 (= SCISRS in Exfor format)	1035		60 393	
Karlsruhe C.P. Library	33		480	
Musgrove Lib. of strength function	29		916	
NNCSC Photo-neutron Lib.	70		49 538	
Dastar	5		15	
EVALUATED (TOTAL)	5408	2583		

	Data Sets* disseminated
AUL + BOL	281
BOYAD	55
DASTAR	396
DEVILLERS	635
CHARGED PART-ENDF	612
ENDF/B-IV 7 st.	40
ENDF/B-Fiss. Prod.	1650
ENDF/B-Dosimetry	139
ENDF/B-Dosimetry Group	54
French ENDF	1
KEDAK	133
LLLENDL	367
MUSGROVE	
SAND II	258
UK	588
	5408

* Data Set = either one Exfor subentry (not counting subentry 001) or one total or partial DFN, Mat. number, etc. of an evaluated data library.

Figure 5

Z A Q R E Q U E S T S T A T I S T I C S

1 Apr. 1975 - 31 Mar. 1976

AREA 3

Element	A	All	TOT	SEL DEL	SIN DIN	NG SNG	NF	N2N NA ND NT	NP	RES	Other
ALL											
MANY											
H											
D											
Li											
Be											
B											
C											
N											
Ø											
F											
Na											
Mg											
Al											
Si											
P											
Cl											
K											
Ca											
Sc											
Ti											
V											
Cr											
Mn											
Fe											
Co											
Ni											
Cu											
Zh											
Y											

Figure 5 (cont)

Z A Q R E Q U E S T S T A T I S T I C S (continued)

Element	A	All	TOT	SEL DEL	SIN DIN	NG SNG	NF	N2N NA ND NT	NP	RES	Other
Zr											
Nb											
Mo											
Rh											
Ag											
Cd											
In											
I											
Ba											
La											
Sm											
Eu											
Dy											
Ho											
Hf											
W											
Pt											
Au											
Hg											
Tl											
Pb											
Bi											
Th	232										
Pa	233										
U	233										
	234										
	235										
	236										
	238										
Pu	239										
	240										
	241										
	242										
Am	242										
Cm	245										
Cf	252										

D.5.4 EXFOR

The EXFOR system has been modified according to the Four Centre agreements, to implement the keyword XDATA and NOSUBENT and to allow an unlimited number of data-columns. The checking programme has been improved to include correlation checks between certain keywords and data-headings; input for extraction from the master files has been improved to make automatic linkage to the index easier and REACTION has been partly implemented. While making these modifications, changes were also made to improve system performance and reduce costs. A new programme module has been introduced to provide literature coverage control lists as an aid to NDS compilers.

The next important addition is the implementation of all the keywords needed for CPND, including those words used for neutron reaction data. This involves modifications, in particular, to the checking and edit-listing programmes.

D.5.5 WRENDA

A few minor changes have been made to the WRENDA system to comply with INDC recommendations; the changes are listed in section C.1 on WRENDA.

D.5.6 CINDA

The CINDA input checking programme is fully implemented. The changes during this reporting period include the usage of EXFOR dictionaries for checking the reference field and the implementation of the 'kill and link' operations.

NDS receives the full CINDA master file 4 or 5 times per year from CCDN and various lists of entries from the NDS area are made for the compilers.

The photo-composition programmes have been revised to prepare tapes for either a LINOTRON or DIGISET phototypesetting machine.

D.5.7 Evaluated Data Libraries

This operation has continued without change except for an increase in the number of libraries handled and the implementation of an edit-listing programme for libraries in ENDF format, which was received from CPL.

D.5.8 Requests for Programming Services

NDS has received a number of requests for programmes, mostly concerned with EXFOR. When such requests could be satisfied by sending documentation and/or programmes already in existence this has been done. In other cases action has been delayed until the features requested are implemented for use also at NDS.

APPENDIX 1

Current List of Liaison Officers to the INDC

Argentina	Ricabarra, G.
Austria	Eder, O.J.
Bangla Desh	Islam, M.
Belgium	Poortmans, F.
Bolivia	Mariaca, F.
Brazil	Herdade, S.B.
Bulgaria	Nadjakov, E.
Chile	Martens Cook, P.
Colombia	Director, Instituto de Asuntos Nucleares
Czechoslovakia	Rocek, J.
Denmark	Christensen, C.J.
Ecuador	Munoz, R.
Egypt	El-Nady, M.
Finland	Silvennoinen, P.
German Democratic Republic	Seeliger, D.
Greece	Dritsa, S.
Hungary	Kluge, G.
Iran	Etemad, M.A.
Iraq	Said, K.I.
Israel	Amiel, S.
Jamaica	Chen, A.A.
Kenya	Gacii, P.
Korea, Dem. Peoples Rep.	Dzang, S.H.
Korea, Republic of	Cho, M.
Kuwait	Shihab-Eldin, A.
Mexico	Graef Fernandez, C.
Netherlands	Bustraan, M.
Norway	Andersen, E.
Pakistan	Khan, A.M.
Philippines	Navarro, Q.O.
Poland	Sujkowski, Z.
Portugal	Carvalho, F.G.
Romania	Rapeanu, S.N.
South Africa	Reitmann, D.
Spain	Velarde Pinacho, G.
Switzerland	Huerlimann, Th.
Thailand	Boonkong, W.
Turkey	Ertek, C.
Uruguay	Lalanne, A.
Yugoslavia	Slaus, I.
Zaire	Pollak, H.

APPENDIX 2

List of Review Papers Presented at the Advisory Group Meeting on Transactinium Isotope Nuclear Data

A. Survey of TND Applications

1. General Survey of Applications of Actinide Nuclear Data in the Nuclear Fuel Cycle and the Nuclear Industry. (S. Raman)

2. Importance of TND in the Physics Design of Fast and Thermal Reactor Cores. (J.Y. Barré, J. Bouchard)

3. Sensitivity Studies of Build-up of Actinides during Normal Reactor Operations. (H. Kuesters)

4. Importance of TND for Engineering Design and Operations of Reactors. (R.G. Nunn)

5. Importance of TND for Fuel Handling (excluding waste management). (B.L. Richardson)

6. European Programmes in Waste Management (Incineration) of Actinides. (L. Koch)

7. US Programmes in the Waste Management (Incineration) of Actinides. (S. Raman)

8. Importance of TND for Fuel Analysis. (R. Dierckx)

9. Importance of TND in Non-reactor Applications. (A.H.W. Aten, Jr.)

B. Review of TND Status

1. Status of Measured Neutron Cross Sections of Transactinium Isotopes for Thermal Reactors. (R.W. Benjamin)

2. Status of Neutron Cross Sections of Transactinium Isotopes in the Resonance Energy Region - Linear Accelerator Measurements. (G.D. James)

3. Status of Neutron Cross Section of Transactinium Isotopes in the Resonance and Fast Energy Regions - Underground Nuclear Explosion Measurements. (M.S. Moore)

4. Status of Measured Neutron Cross Section of Transactinium Isotopes in the Fast Region. (S. Igarasi)

5a. Status of Transactinium Isotope Evaluated Neutron Data in the Energy Range 10^{-3} eV to 15 MeV. (S. Yiftah)

5b. Evaluation and Theoretical Calculation of TND. (J.E. Lynn)

6. Status of Alpha Decay Data of the Transactinium Isotopes. (A.G. Zelenkov/S.A. Baranov)

7. Status of Beta and Gamma Decay and Spontaneous Fission Data from Transactinium Isotopes. (C.W. Reich)

APPENDIX 3

IAEA Consultants Meeting on the Use of Nuclear Theory

ICTP, Trieste, 8-11 December 1975

List of review papers

RP 1a A. Prince

The role and use of nuclear theories and models in practical evaluation of neutron nuclear data needed for fission and fusion reactor design and other nuclear applications.

RP 1b M.K. Mehta

The role and importance of the use and development of applied nuclear theory and computer codes for neutron nuclear data evaluation in developing countries.

RP 2 P.A. Moldauer

Statistical theory of neutron nuclear reactions.

RP 3 G. Longo and F. Saporetti

Radiative capture of 5-20 MeV neutrons.

RP 4 A.V. Ignatyuk

Statistical characteristics of excited nuclei.

RP 5 J.P. Delaroche, Ch. Lagrange and J. Salvy

The optical model with particular consideration of the coupled-channel optical model.

RP 6 D. Seeliger

Pre-equilibrium emission in neutron induced reactions.

RP 7 J.E. Lynn

Fission theory and its application to the compilation of nuclear data.

International Atomic Energy Agency
Technical Committee on the
Treatment of Nuclear Data
Sources in INIS
Vienna, 1-2 April 1976

TC-82/11

Recommendations

The Committee recognized that its primary purpose is to foster a spirit of cooperation between INIS and numerical information analysis centres. All the recommendations listed below are intended to serve this purpose:

1) It is considered desirable that measures should be taken to improve and refine the methods of data identification (data indexing) in INIS.

2) Whatever measures are taken should in so far as possible fit within the pattern of current structure, procedures and services in the existing systems and centres.

3) It would be well for INIS to ensure that these measures are compatible with proposals being evaluated by other mechanized information services and appropriate international bodies (CODATA etc.).

4) The general principle of data indexing in INIS should be further studied on the basis of replies to an INIS Technical Note which should include:

   a) Use of presently available data indexing means (literary indicator N, existing descriptors, notes, title augmentation, abstracts, M/Q labels);

   b) Refining the means cited in a above (new descriptors, additional literary indicators, more informative abstracts, variations of descriptor labelling, etc.);

   c) Introduction of a new tagged field(s) which should contain more precise data identifiers;

   d) The proposal that an INIS record should contain no more numerical values than a good informative abstract.

5a) The decisions to be taken on 4 above as well as the specific guidelines for the content of the possible new tag(s) should be based on user-need evaluations by the national INIS Liaison Officers and by members of INDC and nuclear data centres.

5b) The nuclear data centres represented at the meeting requested that an INIS record should contain, in addition to a gross data classification, explicit information on data presentation and purpose in controlled language.

6) The method of indentifying data by means of appropriate pointers as proposed by Mr. N. Tubbs should be further elaborated by the author to form the basis for another INIS Technical Note on this subject. It is clear, however, that this method requires the establishment of a second INIS output file which many Committee members felt represents a major change in INIS.

APPENDIX 5

Centres and groups active in compilation or dissemination of Charged Particle Nuclear Data, comprising the CPND centre network

CAJaD	Dr. F.E. Chukreev Center for Nuclear Structure & Reaction Data of the USSR State Committee on the Utilization of Atomic Energy I.V. Kurchatov Institute of Atomic Energy Moscow, USSR
KaChaPaG	Prof. H. Muenzel Charged Particle Nuclear Data Group Institut f. Radiochemie Kernforschungszentrum Karlsruhe Postfach 3640 D-75 Karlsruhe, Fed. Rep. of Germany
NNCSC	Dr. S. Pearlstein National Neutron Cross Section Center Brookhaven National Laboratory Upton, L.I. N.Y. 11973, USA
NDS	Dr. J.J. Schmidt Nuclear Data Section Div. of Research and Laboratories IAEA, P.O.B. 590 Kaerntnerring 11 1011 Vienna, Austria
Study Group for Information Processing in Nucl. Physics	Prof. H. Tanaka Department of Physics Hokkaido University Sapporo, Hokkaido, Japan
Harwell	Dr. G. Dearnaley Nuclear Physics Div., Hangar 8 Atomic Energy Research Establishment Harwell, Didcot, Oxon OX11 ORA United Kingdom
ZAED	Dr. H. Behrens Zentralstelle f. Atomkernenergie-Dokumentation Kernforschungszentrum D-7514 Eggenstein-Leopoldshafen Fed. Rep. of Germany

IBJ

Dr. A. Marcinkowski
Nuclear Data Group
Inst. Badan Jadrowych
Hoza 69
PL-00-681 Warsaw, Poland

NDCC

Dr. L. Lesca
NEA Neutron Data Compilation Centre
B.P. No. 9
F-91190 Gif-sur-Yvette, France

Dr. D.C. Agrawal
Physics Department
Banaras Hindu University
Varanasi, India 221005

Potential participants in the CPND Centre Network

Dr. S.N. Rapeanu
State Committee for Nuclear
Energy
P.O. Box 5203
Bucharest-Magurele 7000
Romania

Dr. D. Brune
Nordisk Institutt for
Odontologisk Materialproevning
Niom
Forskningsveien 1
Oslo 3, Norway

APPENDIX 6

List of Participants of the 12th Four Center (4C) Meeting and the 2nd CPND Meeting, 26-30 April, 1976

(Ch = chairman, ls = local secretary, ss = scientific secretary, o = observer)

	Meeting attended	
Attree, Mrs. P.M. (IAEA/NDS)	4C	
Behrens, H. (ZAED, Karlsruhe)		CPND
Chukreev, F.E. (CAJaD, Moscow)		CPND
Dearnaley, G. (Harwell, UK)		CPND
Dunford, C.L. (NNCSC, Brookhaven)	4C	CPND(Ch)
Erdtmann, G. (KFA Juelich)		CPND
Holden, N.E. (NNCSC, Brookhaven)	4C	CPND
Kondurov, I.A. (Leningrad-Gatchina LIYaF)		CPND
Kronenberger, F. (KaChaPaG, KFK, Karlsruhe)		CPND
Lammer, Mrs. G. (IAEA/NDS)	4C(ls)	CPND(ls)
Lemmel, H.D. (IAEA/NDS)	4C(ss)	CPND(ss)
Lesca, L. (NDCC, Saclay)	4C	CPND
Lorenz, A. (IAEA/NDS)	4C	CPND
Manokhin, V.N. (CJD, Obninsk)	4C	CPND
Marcinkowski, A. (IBJ, Swierk, Poland)	4C(o)	CPND
Muenzel, H. (KaChaPaG, KFK, Karlsruhe)		CPND
Ohnuma, H. (Tokyo, Inst. of Techn.)		CPND
Pearlstein, S. (NNCSC, Brookhaven)	4C	CPND
Pronaev, V.G. (CJD, Obninsk)	4C	CPND
Rapeanu, S. (Inst. Atom. Phys., Bucharest)	4C(o)	CPND
Schofield, A. (NDCC, Saclay)	4C	CPND
Schmidt, J.J. (IAEA/NDS)	4C(Ch)	CPND
Schwerer, O. (IAEA/NDS)	4C(ls)	CPND(ls)
Sokolovskij, L.L. (CAJaD, Moscow)		CPND
Tamura, T. (JAERI, Japan)		CPND

APPENDIX 7

Twelfth Four-Centre Meeting

Vienna, 26-27 April 1976

AGENDA

Opening of the meeting, election of chairman, adoption of agenda

1. Status reports of the neutron data centres

2. Cinda

- a. Brief report on the Cinda indexers seminar
- b. Cinda indexer's Manual
- c. Completeness, coverage control and related computer programmes
- d. File maintenance, feedback listings, related computer programmes
- e. Clean-up, blocking, and related computer programmes
- f. Index lines for EXFOR and evaluated data
- g. Quantity definitions
- h. Handbook section in the Cinda-book
- i. Publication schedule
- j. Miscellaneous

3. Wrenda

- a. Report by NDS, INDC conclusions
- b. Reports by other centres

4. Evaluated data

- a. Technical problems
- b. Documentation
- c. Exchange of information on status and quality of available evaluated data
- d. Evaluations being done or to be released

5. Customer services

- a. Request statistics

6. Neutron Exfor

- a. Completeness, coverage control
- b. Experience with exchange tapes, review of errors
- c. Assigning of accession-numbers, superseded data, etc.
- d. Pending proposals, 4C-memos
- e. Manual updating
- f. Generalized Exfor for neutron-data

7. Miscellaneous

8. Next 4C-Meeting

APPENDIX 8

Advisory Group Meeting on

Nuclear Structure and Decay Data for Applications

Vienna, 3-7 May 1976

List of participants

BAMBYNEK, W., BCMN Geel, Belgium
BEHRENS, H., ZAED Karlsruhe, Fed. Rep. of Germany
BERÉNYI, D., Debrecen, Hungary
BERTRAND, F., NDP, ORNL, USA
BLACHOT, J., CEN Grenoble, France
CARLÉN, L., Lund, Sweden
CHUKREEV, F.E., CAJaD, Moscow, USSR
DUNFORD, Ch., NNCSC, BNL, USA
ERDTMANN, G., KFA Juelich, Fed. Rep. of Germany
HOLDEN, N.E., NNCSC, BNL, USA
IVASCU, M., INP Bucarest, Romania
KONDUROV, I.A., Leningrad-Gatchina LIYaF, USSR
LEGRAND, J., CEN Saclay, France
LORENZ, A. NDS, IAEA (Scientific Secretary)
MARCINKOWSKI, A., IBJ Warsaw, Poland
NICHOLS, A.L., AERE Harwell, UK
OHNUMA, H., Tokyo, Japan
OKAMOTO, K., NDS, IAEA
PEARLSTEIN, S., NNCSC, BNL, USA (Chairman)
REFFO, G., CNEN Bologna, Italy
SCHMIDT, J.J., NDS, IAEA
SOKOLOVSKIJ, L.L., CAJaD, Moscow, USSR
TAMURA, T., JAERI, Japan
TWIN, P., Liverpool, UK
VAN DER LEUN, C., Utrecht, Netherlands
VONACH, H.K., Vienna, Austria

APPENDIX 9

19th Meeting of NEANDC

Stockholm, 20-24 September 1976

Technical Agenda

1. Relations of NEANDC with other international committees

2. National progress reports on nuclear data measurements and activities

3. Advances in measurements and evaluations of neutron data

4. New and continuing nuclear data needs

5. International co-operation in nuclear data measurements, analyses and evaluation

6. Data indexing, compilation and evaluation

7. Meetings and conferences on nuclear data

8. Discussion of the reports from NEANDC subcommittees

9. Topical discussion on integral and differential after-heat measurements at Studsvik

APPENDIX 10

19th Meeting of NEANDC

Stockholm, 20-24 September 1976

List of Participants

Committee members

K.H. Boeckhoff, CBNM Geel, Belgium
R.E. Chrien, Brookhaven, USA
S. Cierjacks, Karlsruhe, Federal Republic of Germany (chairman)
C. Coceva, Bologna, Italy
H. Conde, Research Institute of National Defense, Stockholm, Sweden
W.G. Cross, Chalk River, Canada (vice-chairman)
E. Fort, Cadarache, France
H.E. Jackson, Argonne, USA
A. Michaudon, Bruyères-le-Châtel, France
H. Motz, Los Alamos, USA
S. Qaim, Juelich, Federal Republic of Germany
J. Rosen, OECD/NEA, Paris, France
M. Sowerby, Harwell, UK (scientific secretary)
J. Story, Winfrith, UK
K. Tsukada, JAERI, Japan
N. Tubbs, OECD/NEA, Paris, France (secretary)

Observers

J. de Meulder, CBNM Geel, Belgium
L. Lesca, CCDN, OECD/NEA, Saclay, France
J.J. Schmidt, IAEA, Austria
L.G. Stroemberg, Stockholm, Sweden (local secretary)

APPENDIX 11

Joint IAEA-OECD (NEA) Technical Committee Meeting on Differential and Integral Nuclear Data Requirements for Shielding Calculations

Vienna, 12-15 October 1976

Summary remarks from the IAEA Nuclear Data Section

The major outcome of this meeting was to pinpoint the cross section areas of major importance to shielding. The open problem is what energy and angular detail is needed by shield designers? Must shield designers have more of Perey-type measurements?

At this moment it seems not yet possible to draw up a request list for shielding data. From the papers presented it would be useful to excerpt a few pages summary on cross section needs.

The following five general requirements seem to emerge from this meeting:

1. A better documentation of evaluated data files modelled on the ENDF/B data documentation.

2. The major evaluated nuclear data libraries should be updated and the reasons for remaining discrepancies be investigated in detail.

3. Uncertainty files should be added to evaluated nuclear data files.

4. In the preparation of next meeting measurers and evaluators should have a close look at and should improve the data required for shielding as apparent from this meeting.

5. Sensitivity and benchmark studies should be pursued simultaneously, particularly in order to find out about the importance of detailed Perey-type cross section structure to be taken into account in shielding calculations.

The next meeting on nuclear data for shielding should be held in about 1978. In preparation of this meeting there should be a better interaction between the shielding and data communities. In particular should the shielding experts communicate their updated requirements early enough to the data specialists so that they could find out about the status of the required data well before the meeting. The meeting itself could then devote more time to reach decisions on future work needed.

APPENDIX 12

IAEA Advisory Group Meeting on

Atomic and Molecular Data for Fusion

Culham Laboratory, 1-5 November 1976

Meeting Agenda

Monday, 1 November

- Opening of the meeting
- Welcome on behalf of IAEA: J.J. Schmidt
- Welcome on behalf of Culham: R.S. Pease
- Opening address: Sir Harry Massey
- Meeting organization: A. Lorenz
  - Meeting schedule and organization
  - Appointment of session chairmen and working group chairmen

First presentation session: C.F. Barnett, chairman

- First introductory paper
  "The Role of Atomic and Molecular Processes in Fusion Research", M.F.A. Harrison
- Second introductory paper
  "Proposed IAEA Programme on A+M Data for Fusion", J.J. Schmidt
- Review Paper A1
  "Data Needs, Priorities and Accuracies for Beam Injection", J.T. Hogan
- Review Paper A2
  "Data Needs, Priorities and Accuracies for Plasma Surface Interactions", H. Vernickel
- 1st Contributed Paper to topic A2
  "Blistering of Stainless Steel by He^+ Ions", B. Navinšek
- 2nd Contributed Paper to topic A2
  "Investigation of Sputtering and Secondary Ion Yield from Metals under Bombardment of Noble Gases", H. Krebs
- Review Paper A3
  "Data Needs, Priorities and Accuracies for Plasma Modelling", M.L. Watkins

- First Contributed Paper to topics A3 and A4
  "Survey on the Scattering of Electron by Atoms", C. Joachain

- Panel Discussion of Technical Objectives
  (Drs. Barnett, Hogan, McCracken and Drawin
  panelists and Dr. Harrison, moderator)

Tuesday, 2 November

- Review Paper A4
  "Data Needs, Priorities and Accuracies in Considerations of Plasma Impurities and Cooling", H.W. Drawin

- Second Contributed Paper to topics A3 and A4
  "Cross Section Data Including Atoms and Ions in the Highly Excited Rydberg States", S. Ohtani

- Review Paper A5
  "Data Needs, Priorities and Accuracies for Plasma Diagnostics", R.W.P. McWhirter

- 1st Contributed Paper to topic A5
  "Techniques for the Calculation of Atomic Data Required for Plasma Diagnostics", H.E. Saraph

- 2nd Contributed Paper to topic A5
  "Measurements of Atomic Transition Probabilities in Highly Ionized Atoms by Fast Ion Beams", I. Martinson

Second presentation session: H. Suzuki, Chairman

- Review Paper B1
  "National Programmes and Emphasis in France", J.L. Delcroix

- Review Paper B2
  "National Programmes and Emphasis in the Federal Republic of Germany", F. Waelbroeck

- Review Paper B3
  "National Programmes and Emphasis in Japan", H. Suzuki

- Contributed Paper to topic B3
  "Activities on Atomic and Molecular Data in JAERI", Y. Nakai (JAERI)

- Review Paper B4
  "National Programmes and Emphasis in the USSR", Yu.V. Martynenko

- Review Paper B5
  "National Programmes and Emphasis in the United Kingdom"
  M.F.A. Harrison

- Contributed Paper to topic B5
  "(Storage and Retrieval of Bibliographic and Numerical Atomic and Molecular Data at the Queen's University in Belfast)",
  F.J. Smith

- Review Paper B6
  "National Programmes and Emphasis in the USA", C.F. Barnett

- Contributed Paper to topic B6
  "Atomic Physics Program of the Division of Physical Research of ERDA", J.V. Martinez

- Contributed Paper to topic B6
  "Atomic Data Compilation and Evaluation Programmes at NBS",
  W.L. Wiese

- Contributed Paper to topic B6
  "Activities of the Management Research Project at the Lawrence Livermore Laboratory", V. Hampel

- Panel Discussion of Technical Objectives
  (same panelists and moderator as on Monday) and
  organization of working groups

Wednesday, 3 November

- Working group meetings throughout the day

Thursday, 4 November

- Working group meetings. Working groups to finalize their draft reports

- Culham laboratory tour

Friday, 5 November

- Plenary Session: Discussion and Approval of Working Group Reports

APPENDIX 13

Composition of the Joint IFRC/INDC Subcommittee on A+M Data for Fusion and List of Participants of its First Meeting

Members of the Subcommittee	Present at this meeting
C.M. Braams (IFRC chairman)	C.M. Braams
J. Decker (IFRC)	J. Decker
H.W. Drawin (IFRC)	H.W. Drawin
T. Fuketa (INDC)	H. Suzuki + Y. Nakai (proxy for Fuketa)
Yu.V. Martynenko (IFRC)	Yu.V. Martynenko
M.K. Mehta (INDC)	B. Rose (proxy for Mehta)
J. Phillips (IAEA)	(not present)
J.J. Schmidt (INDC)	J.J. Schmidt
G.B. Yankov (INDC)	(not present)

Others attending the meeting

A. Lorenz (IAEA), Advisor to J.J. Schmidt (IAEA)

M.F.A. Harrison (Culham), Observer

APPENDIX 14

IAEA Consultants' Meeting on

Integral Cross-Section Measurements in Standard Neutron Fields

Vienna, 15-19 November 1976

List of Participants

DE LEEUW-GIERTS, G., CEN Mol, Belgium
DE LEEUW-GIERTS, S., CEN Mol, Belgium
ERTEK, C., Seibersdorf Laboratory, IAEA
FABRY, A., CEN Mol, Belgium
FARINELLI, U., CSN Casaccia, Italy
GARLEA, I., INT Bucharest, Romania
GRUNDL, J.A., NBS, Washington, USA (Chairman)
HANNAN, A.H.M.A., Ascot, Berkshire, UK
KIMURA, I., Kumatori, Osaka, Japan
KNITTER, H.H., BCNM, Geel, Belgium
LAMMER, G., NDS, IAEA
LESSLER, R., NDS, IAEA (observer)
LLORET, R., CEN Grenoble, France
MACCRACKEN, A.K., AEE Winfrith, UK
MAGURNO, B., NNCSC, BNL, USA
MANNHART, W., PTB Braunschweig, Fed. Rep. of Germany
MCELROY, W.N., Hanford, USA
NAJZER, D., Ljubljana, Yugoslavia
OKAMOTO, K., NDS, IAEA (observer)
RAHN, F.J., EPRI, Palo Alto, USA
REIJONEN, H., Physics Section, IAEA (observer)
SCHMIDT, J.J., NDS, IAEA
VLASOV, M., NDS, IAEA (Scientific secretary)
VONACH, H.K., Vienna, Austria
WAGNER, S., PTB Braunschweig, Fed. Rep. of Germany
WILLIAMS, J.G., Ascot. Berkshire, UK
ZIJP, W.L., ECN Petten, Netherlands

APPENDIX 15

IAEA Consultants' Meeting on Integral Cross-Section Measurements in Standard Neutron Fields for Reactor Dosimetry

Vienna, 15-19 November 1976

Summary of Conclusions

1. The most significant advances in the dosimetry benchmark programme since September 1973 are the following:

   - The availability of the ENDF/B-IV Dosimetry File and its wide use as a reference set,

   - an improved characterization by measurements and calculations of the benchmark neutron fields,

   - the collection and compilation of information on benchmarks,

   - a number of consistent applications of benchmark measurements to spectrum and/or cross-section validation or correction.

2. The most significant conclusions reached at this meeting are:

   - The identification of a limited number of standard neutron fields (thermal, 1/E, ^{252}Cf spontaneous fission) and of Category I dosimetry reactions ($^{197}Au(n,\gamma)^{198}Au$; ^{237}Np (n,f) F.P.; $^{238}U(n,f)$ F.P.; $^{56}Fe(n,p)^{56}Mn$; $^{27}Al(n,\alpha)^{24}Na$; $^{63}Cu(n,2n)^{62}Cu$; $^{58}Ni(n,2n)^{57}Ni$). Reaction rate measurements of Category I reactions in the standard field yield results consistent with calculations using ENDF/B-IV cross-sections and the recommended representations of the standard spectra.

   - The agreement on the principles of a procedure to use measurements in benchmark fields to improve the knowledge of the reference fields and controlled environments and/or of CategoryII reaction cross-sections.

3. Some of the most important recommendations coming from the meeting are:

   - ENDF/B-IV dosimetry cross-sections and agreed representations for the standard spectra should be used, at least in parallel with other cross-sections and representations.

- Efforts should be made to remove inconsistencies between integral measurements and differential evaluations at least as concerns the ^{235}U fission spectrum, the $\sum\sum$-type facilities and the ISNF, and the cross-sections for $^{58}Ni\ (n,p)^{58}Co$; $^{235}U(n,f)$ F.P., $^{59}Co(n,\gamma)^{60}Co$; $^{115}I(n,n')^{115}In^{m}$, $^{54}Fe(n,p)^{54}Mn$; $^{103}Rh(n,n')^{103}Rh^{m}$ and some others, see page 29, so as to qualify them as standard spectra and Category I reactions, respectively.

- Some assessment of errors and of correlations should be made for the dosimetry cross-sections.

- Further efforts should be made to arrive at a better characterization of benchmark neutron fields, including interlaboratory measurements and calculations; it is important that some indications on the confidence to assign to fluxes and spectra are reached.

- Efforts to improve the knowledge of Category II reactions should be focused with first priority on a restricted number of reactions of primary interest for dosimetry applications.

- Simultaneous analysis of measurements of several reactions in different benchmark fields appears the most promising way to arrive at physically meaningful results; such analyses should be carried out in several laboratories and the results compared.

- The necessity of a limited number of new differential measurements and evaluations of dosimetry cross-sections has been identified; for all the other reactions of interest for dosimetry, the improvement of cross-sections is expected to derive from a combination of integral and differential measurements when available, which should yield internally consistent data.

- International cooperation is essential in reaching these goals; closer links should be established between the present programme and other programmes sponsored by the IAEA and by other international organizations, so that the full variety of available and identified benchmark fields is employed.

- Substantial efforts should be undertaken, preferably by the IAEA Seibersdorf Laboratory, to create a p ol of dosimetry materials (in particular fissionable isotopes) accessible to the whole dosimetry community.

APPENDIX 16

INTERNATIONAL ATOMIC ENERGY AGENCY
INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS

Winter Courses on Nuclear Physics and Reactors 1978

Two related winter courses on Nuclear Theory for Applications and on Reactor Theory and Power Reactors will be conducted at the International Centre for Theoretical Physics, Trieste, Italy, within the framework of its nuclear physics activities. These courses will be organized by the Nuclear Data Section of the Division of Research and Laboratories and the Division of Nuclear Power and Reactors of the International Atomic Energy Agency, Vienna, Austria in cooperation with the Trieste Centre and the Comitato Nazionale per l'Energia Nucleare (CNEN) of Italy. The courses will be organized by:

Dr. J.J. Schmidt	Dr. J.A. Larrimore	Prof. V. Benzi	Prof. L. Fonda
Div. of Research and Laboratories, IAEA	Div. of Nuclear Power and Reactors, IAEA	CNEN, Bologna	ICTP, Trieste

together with leading scientists in the field.

Part I

Course on Nuclear Theory for Applications

16 January - 10 February 1978

The purpose of this Course is to review the contemporary status of research on low energy nuclear theory and to train scientists on an advanced level in the application of nuclear theory and associated computer codes to the interpretation and prediction of neutron nuclear data needed for nuclear reactor calculations. Lectures will be delivered by a distinguished international faculty. There will be an average of about four scheduled lectures per day (5 days per week) together with formal and informal seminars on a variety of topics by lecturers, participants and visiting experts.

The Course is intended for theoretical and experimental nuclear physicists working in applied and basic research, nuclear data evaluators and reactor scientists with an interest in nuclear theory and nuclear data. A post-doctoral or equivalent educational career and/or some years of study and research after a first degree is a prerequisite in order to attend the Course.

The Course is open to nuclear scientists from all countries of the world that are members of the IAEA or UNESCO. One of the main purposes of the Centre is to help research workers from developing countries and this Course is especially directed to nuclear scientists from developing countries which have plans to embark on a nuclear power programme. However, scientists from advanced countries will also be welcome to attend the Course. As the Course will be conducted in English, participants should have an adequate knowledge of that language.

The Course will be started by a review lecture on methods of neutron nuclear data evaluation and continued with a series of lectures on the following research topics:

1. Theory and interpretation of neutron resonances including resolved resonance and statistical distribution laws for partial level widths and level spacings.

2. Advanced neutron optical models including foundations and parameterization of spherical and deformed optical potentials with an emphasis on coupled channel and matrix methods.

3. Statistical theory of neutron nuclear reactions including its relationship to direct, compound, pre-equilibrium and door-way reaction mechanisms, and nuclear single-particle and collective level density theories.

4. Theory and models of pre-equilibrium decay in neutron nuclear reactions.

5. Theory of neutron-induced nuclear fission with an emphasis on the double-hump fission barrier, its properties and parameterization.

Each of the topics above will be treated in three sessions as follows:

I In-depth reviews on the present state of research.

II Detailed lectures on the application of theory and models to the interpretation and prediction of neutron cross-sections and secondary particle distributions needed for nuclear technology; this will include discussions on the validity of assumptions and approximations and a critical assessment of attainable accuracies.

III Detailed introductions to widely used and/or more recently developed nuclear theory and model computer codes for neutron nuclear data computations.

As a rule, it is expected that travel costs to and from Trieste, as well as subsistence expenses of the participants, are borne by the home institution. Financial support may, however, be granted to a limited number of participants from developing countries who will be selected by the Organizing Committee. Requests for financial support should be made in a letter addressed to the Deputy Director of the ICTP and submitted with the request for participation forms. The closing date for requesting participation grants is 15 June 1977. Participants whose expenses are borne by their own country may apply up to 15 October 1977.

Part II

Course on Reactor Theory and Power Reactors

13 February - 10 March

The purpose of this Course is to offer nuclear physicists, engineers and scientists with the appropriate educational and/or professional background, a broad and thorough review of reactor theory and applications in the light of engineering requirements for power reactor design and operation. Current calculational methods will be emphasized. Lectures will be delivered by a distinguished international faculty. There will be an average of about four scheduled lectures per day (5 days per week) together with formal and informal seminars on a variety of topics by lecturers, participants and visiting experts.

The Course is open to nuclear scientists and engineers from all countries of the world that are members of the IAEA or UNESCO. One of the main purposes of the Centre is to help research workers from developing countries and this course is especially directed to physicists and engineers from developing countries which have plans to embark on a nuclear power programme. However, scientists and engineers from advanced countries will also be welcome to attend the Course. Participants should preferably have completed some years of research. As the course will be conducted in English, participants should have an adequate knowledge of that language.

The first two weeks of the course will be devoted to the main theoretical and calculational methods needed by reactor physicists. The following topics will be covered:

NUCLEAR REACTOR STATICS
Nuclear data for reactor calculations
Theoretical methods for steady state reactor calculations

NUCLEAR REACTOR KINETICS AND DYNAMICS
Theoretical foundations and methods

BURNUP AND OPERATIONAL PHYSICS
Long term reactor behaviour
Neutronics and reactor operation

NUCLEAR REACTOR SHIELDING
Problems and methods

The second half of the Course will focus on the reactor physics of specific nuclear power reactors and on power reactor neutronic calculations, covering the following topics:

REACTOR PHYSICS OF POWER REACTORS
Light water, heavy water and advanced reactors

CODES FOR POWER REACTOR NEUTRONIC CALCULATIONS
Steady state and dynamic calculations, starting from nuclear data files
Burnup and fuel management calculations
Neutron and gamma-ray shielding

The course is designed so that participants may attend the full four weeks or only the second half of the course. In addition, participants in Part I of the Winter Courses on Nuclear Physics and Reactors, the Course on Nuclear Theory for Applications (16 January - 10 February 1978), may stay on for either the first two weeks or the full four weeks of Part II. Participants should indicate their preference in their application.

As a rule, it is expected that travel costs to and from Trieste, as well as subsistence expenses of the participants, are borne by the home institution. Financial support may, however, be granted to a limited number of participants from developing countries, who will be selected by the Organizing Committee. Requests for financial support should be made in a letter addressed to the Deputy Director of the ICTP and submitted with the request for participation forms. The closing date for requesting participation grants is 15 June 1977. Participants whose expenses are borne by their own country may apply up to 15 October 1977.

APPENDIX 17

2nd Consultants' Meeting of Nuclear Reaction Data Centres ("2nd NRDC Meeting")

Kiev, USSR, 11-16 April 1977

Tentative Agenda (Draft of 13 Jan. 1977)

Part 1 will be of primary interest to the representatives of the Four Neutron Data Centres.

Part 2 will be relevant to representatives of all cooperating centres and groups.

Observers are welcome to all parts of the Meeting.

Part 1: Neutron Nuclear Data

Monday, 11 April and Tuesday, 12 April

1. Opening, election of Chairman, adoption of agenda
2. Brief status reports of the Centres (on neutron data only)
3. Cinda
   a. clean-up and blocking
   b. Cinda Manual
   c. publication schedule
   d. other matters
4. Wrenda
5. Evaluated data
6. Exfor Manual
   a. pending proposals (if related to neutron data only)
   b. revision of the Protocol (Memo 4C-1/104)
7. Implementation of the Generalized Exfor System for neutron data
8. Miscellaneous
9. Conclusions

Part 2: All Nuclear Reaction Data

Wednesday, 13 April to Saturday, 16 April

10. Opening, election of Chairman, adoption of agenda
11. Brief status reports of the Centres
12. Exfor Manual
    a. Memo CP-D/13 (CPND Supplement)
    b. other pending proposals
13. Photonuclear Data
14. Cooperation, experiences with TRANS tapes, etc.
15. CPND Bibliography
16. Nuclear Data Tagging and Flagging in INIS
17. Customer services
    a. Activities and plans of the Centres
    b. Special problems of countries starting to have nuclear data files for specific applications
18. Future developments: compilation requirements, relevant recommendations from other meetings, developments of data centres, etc.
19. Miscellaneous
20. Conclusions
21. Date and place of next NRDC Meeting

APPENDIX 18

MEMBERS OF THE A+M DATA CENTRE NETWORK

Centre Code	Address	Head of Project or Centre
FR/Orsay	Laboratoire Physique des Plasmas Faculte des Sciences d'Orsay Batiment 212 F-91400 Orsay	Prof. J.L. Delcroix
FRG/ZAED	Zentralstelle fuer Atomkernenergie-Dokumentation Kernforschungszentrum D-7514 Eggenstein-Leopoldshafen	Dr. G. Ebel
FRG/Garching	Surface Physics Division Max Planck Institute for Plasma Physics D-8046 Garching bei Muenchen	Dr. H. Vernickel
IAEA/NDS	Nuclear Data Section International Atomic Energy Agency P.O. Box 590 A-1011 Vienna	Dr. J.J. Schmidt
JAP/Nagoya	Atomic Data Study Group Institute for Plasma Physics Nagoya University Nagoya 464, Japan	Prof. H. Suzuki
JAP/JAERI-A+M	Division of Physics Japan Atomic Energy Research Institute Tokai-Mura, Naka-gun Ibaraki-ken 319-11, Japan	Dr. T. Fuketa
UK/Belfast	Computer Centre Queens University Belfast, B17 1NN Northern Ireland, UK	Dr. F.J. Smith
US/NBS-AT	Data Centers on Atomic Transition Probabilities and Atomic Line Shapes and Shifts Optical Physics Division National Bureau of Standards Washington, D.C. 20234, USA	Dr. W.L. Wiese

Appendix 18 cont'd

Centre Code	Address	Head of Project or Centre
US/NBS-EL	Atomic Energy Levels Data Center Optical Physics Division National Bureau of Standards Washington, D.C. 20234, USA	Dr. W.C. Martin, Jr.
US/NBS-JILA	Atomic Collision Cross Section Information Center Joint Institute for Laboratory Astrophysics University of Colorado Boulder, Col. 80302, USA	Dr. E.C. Beaty
US/ORNL-CTR	Controlled Fusion Atomic Data Center Oak Ridge National Laboratory P.O. Box Y Oak Ridge, Tennessee 37830, USA	Dr. C.F. Barnett
USSR/Kurchatov	Institut Atomnoi Energii I.V. Kurchatova 46 Ulitsa Kurchatova Moscow, D-182, USSR	Dr. Yu.V. Martynenko

List of Review Papers (RP) to be presented at the
2nd Advisory Group Meeting on FPND
ECN Petten, Netherlands, 5-9 September 1977

RP 1 Introductory paper

a. Brief summary of the observations, conclusions and recommendations of the FPND Panel in Bologna.

b. A critical review of available compilations and evaluations of FPND.

Reviewer: G. Lammer, IAEA, Vienna, Austria

A. REVIEWS OF FPND NEEDS IN APPLICATION FIELDS

RP 2 Needs and accuracy requirements for FPND of impact to the environment

Main topics: Environmental influence of reactor operation, waste management and related health and safety problems;
Peaceful nuclear explosions and the environment;
Environmental surveillance.
FPs in biology, industry and agriculture.
FPs in astrophysics and cosmology.

Reviewer: D. Beninson, UNSCEAR (UN Scientific Committee on Effects of Atomic Radiation), Vienna, Austria

RP 3 Needs and accuracy requirements for FPND in the physics design of power reactor cores

Main topics: Reactivity lifetime, core safety, power stability;
Fusion reactors: U-238 blankets;
Future technologies.

Reviewer: J.L. Rowlands, AEE Winfrith, UK

RP 4 Needs and accuracy requirements in the engineering design and operation of reactors

Main topics: Fuel design;
Fuel failure detection, contamination of reactor components, (γ,n) processes in structure and coolant materials;
Fission product heating after shutdown.

Reviewer: C. Devillers, CEN/Saclay, France

RP 5 Needs and accuracy requirements for FPND in the out-of-pile fuel cycle

Main topics: Fuel storage and transport, shielding;
Reprocessing and refabrication;
Actinide separation and production;
Waste disposal.

Reviewer: C. Beets, Centre d'Etude de l'Energie Nucleaire
Mol. Belgium

RP 6 FPND requirements for investigations on irradiated nuclear fuel material: burnup, neutron dosimetry, safeguards

Main topics: Calculation of burnup and FP inventory, destructive and non-destructive burnup measurements, as needed in the various fields of application;

Neutron dosimetry: determination of fluence and spectra with the aid of fission detectors.

Safeguards: methods for investigation on spent nuclear fuel as performed by safeguard inspectors.

Reviewer: W.J. Maeck, Allied Chemical Corp., Idaho Falls, USA

B. CRITICAL REVIEW OF THE STATUS OF FPND

RP 7 Status of neutron reaction cross section of fission products in the energy ranges of resolved and unresolved resonances

Main topics: Experimental, evaluated and calculated total elastic and capture cross-sections for s- and p-wave neutrons.

Resolved and average resonance parameters obtained by experiments or systematics.
Maxwellian averaged cross-sections.
Accuracies of measured cross-sections; and of cross-sections calculated by nuclear theory.

Reviewer: E. Fort, CEN/Cadarache, France

RP 8 Impact of integral measurements on the neutron cross-sections of individual fission product isotopes

Main topics: Improvement of neutron reaction cross sections (capture, inelastic, etc.) by integral measurements, results.

Reviewer: H. Gruppelaar, RCN Petten, Netherlands

RP 9 Status of fast neutron reaction cross-sections of fission products

Main topics: Experimental, evaluated and calculated

- Total, elastic and capture cross-sections for incident neutron energies above 100 KeV.
- Inelastic, (n,2n), (n,3n), (n,p), etc. cross-sections above threshold, up to about 15 MeV.
- Fission spectrum averaged cross-sections, infinite dilute resonance integrals.

Accuracies obtained - for measured cross-sections
- for cross-sections predicted by nuclear theory

Systematics found, and their theoretical interpretation.

Reviewer: S. Iijima, NAIG Nuclear Research Laboratory, Japan

RP 10 Status of fission product yield data

Main topics: Cumulative yields in thermal neutron fission and in fast neutron fission up to 14 MeV incident neutron energy.

Dependence of the yields on incident neutron energy and spectrum

Independent yields

Charge dispersion

Yields of light particles from ternary fission

Reviewer: J.G. Cuninghame, AERE Harwell, UK

RP 11 Prediction of unmeasured fission yields by nuclear theory or systematics

Main topics: Theories and methods for predicting unmeasured yields, comparison of results of different methods;

Comparison with experiments, effect of prompt neutrons;

Predictions of the dependence on energy and fissile nuclide.

Reviewer: J.O. Denschlag, Institut f. Kernchemie, Universitaet Mainz, FRG

RP 12 Status of decay data of fission products

Main topics: Decay data for short-lived ($T_{1/2} < 1$ hour) as well as for long-lived FP, i.e.:

half-life

Q-values

gamma ray and conversion electron energies and intensities

β-ray spectra, mean energies and intensities

X-ray and Auger-electron data

branching ratios

Reviewer: J. Blachot, CEN/Grenoble, France

RP 13 Status of delayed neutron data

Main topics: delayed neutron yields/fission
Pn-values
delayed neutron spectra
use of delayed neutron data for testing FPND libraries

Reviewer: G. Rudstam, Swedish Research Council's Laboratory, Sweden

C. REVIEW OF INTEGRAL MEASUREMENTS

RP 14 Integral determination of FP neutron cross-sections

Main topics: Integral cross section measurements and calculations for individual or mixed (or pseudo) fission products.

Reviewer: M. Bustraan, Energy Research Foundation (ECN) Petten, Netherlands

RP 15 Integral determination of fission product inventory and decay power

Main topics: Measurements of total β-, γ-spectra;

Determination of total β-, γ-, β+γ decay power; from a few seconds to years after shutdown;

Calculations of fission product inventory and decay heat using differential data and theoretical bulk estimates;

Adjustment of differential data.

Reviewer: R.E. Schenter, HEDL, Richland, USA

IAEA NUCLEAR DATA SECTION, KÄRNTNER RING 11, A-1010 VIENNA

SHORT GUIDE TO EXFOR

EXFOR - a computerized EXchange FORmat - presents in a convenient compact form experimental numerical data as well as physical information necessary to understand the experiment and interpret the data. Keywords and codes make the information computer intelligible. The structure of EXFOR is briefly described in the following.

Each EXFOR "entry" consists of two or more "subentries". The first subentry of an entry contains information which is common to all the following subentries of that entry. Each subentry may include two types of information: Descriptive text information and numerical data. Each item of descriptive text information is identified by keywords such as TITLE, STANDARD, ISO-QUANT, which may exhibit a code within parenthesis, such as (GELI), (SCIN) for the keyword DETECTOR or (TOF), (COINC) for the keyword METHOD. The meaning of most keywords is self-explanatory. The meaning of most codes is given in the free text following the code. Of particular importance is the keyword "ISO-QUANT". Under this keyword are coded the "isotope and quantity" or, in other words, the reaction and parameter measured.

EXFOR information is available in two formats:

- the "standard format" primarily designed for the international exchange of data in computer processable form, and

- the "edited format" in which coded information and data tables are edited in an easily legible form.

The EXFOR structure, the standard and edited formats are illustrated in example 1.

"EDITED" LISTING

SUB-ACCESSION NUMBER EXFOR 30275.045

BIBLIOGRAPHY, EXPERIMENTAL DESCRIPTION, EXPLANATIONS

ISO-QUANT | 22-TI-0 DIFF.PART.NEUTRON-EMISSION CROSS-SECTION |

(22-TI-0,NEM,DA,PAR)

STATUS DATA WERE OBTAINED BY INTEGRATING OVER A 1 MEV INTERVAL FROM 2 TO 11 MEV THE DOUBLE DIFFERENTIAL CROSS-SECTION GIVEN IN SUBENTRY 11.

CONSTANT PARAMETERS

#1# ANG	= 40.	ADEG	
#2# ANG	= 60.	ADEG	
#3# ANG	= 90.	ADEG	
#4# ANG	= 120.	ADEG	
#5# ANG	= 150.	ADEG	
EN-APRX	= 14.6	MEV	

2

DATA TABLE

DATA DEFINED ABOVE UNDER ISO-QUANT

	1 E-MIN	2 E-MAX	3 DATA-CM #1#	4 DATA-ERR #1#	5 DATA-CM #2#	6 DATA-ERR #2#	7 DATA-CM #3#	8 DATA-ERR #3#	9 DATA-CM #4#	10 DATA-ERR #4#
	MEV	MEV	MB/SR	MB/SR	MB/SR	MB/SR	MB/SR	MB/SR	MB/SR	MB/SR
1	2.	3.	30.88	0.57	24.60	0.25	26.88	0.39	25.19	0.44
2	3.	4.	22.61	0.50	14.99	0.20	14.50	0.24	13.60	0.27
3	4.	5.	13.92	0.30	9.30	0.14	7.94	0.15	6.14	0.13
4	5.	6.	10.17	0.25	7.02	0.11	6.12	0.13	2.79	0.06
5	6.	7.	8.53	0.23	5.73	0.10	4.45	0.12	2.35	0.06
6	7.	8.	7.47	0.22	5.27	0.09	3.43	0.11	1.94	0.06
7	8.	9.	5.94	0.17	4.18	0.08	2.50	0.09	1.04	0.05
8	9.	10.	3.98	0.11	3.02	0.06	1.76	0.06	0.47	0.02
9	10.	11.	2.94	0.08	2.10	0.05	0.95	0.04	0.27	0.01

	11 DATA-CM #5# MB/SR	12 DATA-ERR #5# MB/SR
1	18.06	0.69
2	8.92	0.56
3	3.11	0.40
4	2.86	0.28
5	2.76	0.36
6	1.46	0.14
7	2.46	0.28
8	1.96	0.21
9	0.42	0.16

#1# = 'POINTER', WHICH LINKS RELATED PIECES OF NUMERICAL AND/OR TEXT INFORMATION

"STANDARD" LISTING

```
SUBENT        30275045     750521                                  3027504500001
BIB                2            4                                  3027504500002
ISO-QUANT  (22-TI-0,NEM,DA,PAR)                                    3027504500003
STATUS     DATA WERE OBTAINED BY INTEGRATING OVER A 1 MEV INTERVAL 3027504500004
           FROM 2 TO 11 MEV THE DOUBLE DIFFERENTIAL CROSS-SECTION  3027504500005
           GIVEN IN SUBENTRY 11.                                   3027504500006
ENDBIB             4                                               3027504500007
COMMON             6            3                                  3027504500008
ANG        1ANG    2ANG         3ANG        4ANG        5EN-APRX   3027504500009
ADEG       ADEG    ADEG         ADEG        ADEG        MEV        3027504500010
40.        60.     90.          120.        150.        14.6       3027504500011
ENDCOMMON          3                                               3027504500012
DATA               12           9                                  3027504500013
E-MIN      E-MAX   1DATA-CM     1DATA-ERR   1DATA-CM    2DATA-ERR  3027504500014
DATA-CM    3DATA-ERR 3DATA-CM   4DATA-ERR   4DATA-CM    5DATA-ERR  3027504500015
MEV        MEV     MB/SR        MB/SR       MB/SR       MB/SR      3027504500016
MB/SR      MB/SR   MB/SR        MB/SR       MB/SR       MB/SR      3027504500017
2.         3.      30.88        0.57        24.60       0.25       3027504500018
26.88      0.39    25.19        0.44        18.06       0.69       3027504500019
3.         4.      22.61        0.50        14.99       0.20       3027504500020
14.50      0.24    13.60        0.27        8.92        0.56       3027504500021
4.         5.      13.92        0.30        9.30        0.14       3027504500022
7.94       0.15    6.14         0.13        3.11        0.40       3027504500023
5.         6.      10.17        0.25        7.02        0.11       3027504500024
6.12       0.13    2.79         0.06        2.56        0.28       3027504500025
6.         7.      8.53         0.23        5.73        0.10       3027504500026
4.45       0.12    2.35         0.06        2.76        0.36       3027504500027
7.         8.      7.47         0.22        5.27        0.09       3027504500028
3.43       0.11    1.94         0.06        1.46        0.14       3027504500029
8.         9.      5.94         0.17        4.18        0.08       3027504500030
2.50       0.09    1.04         0.05        2.46        0.28       3027504500031
9.         10.     3.98         0.11        3.02        0.06       3027504500032
1.76       0.06    0.47         0.02        1.96        0.21       3027504500033
10.        11.     2.94         0.08        2.10        0.05       3027504500034
0.95       0.04    0.27         0.01        0.42        0.10       3027504500035
ENDDATA            22                                              3027504500036
ENDSUBENT          35                                              3027504599999
ENDENTRY           2                                               3027599999999
```

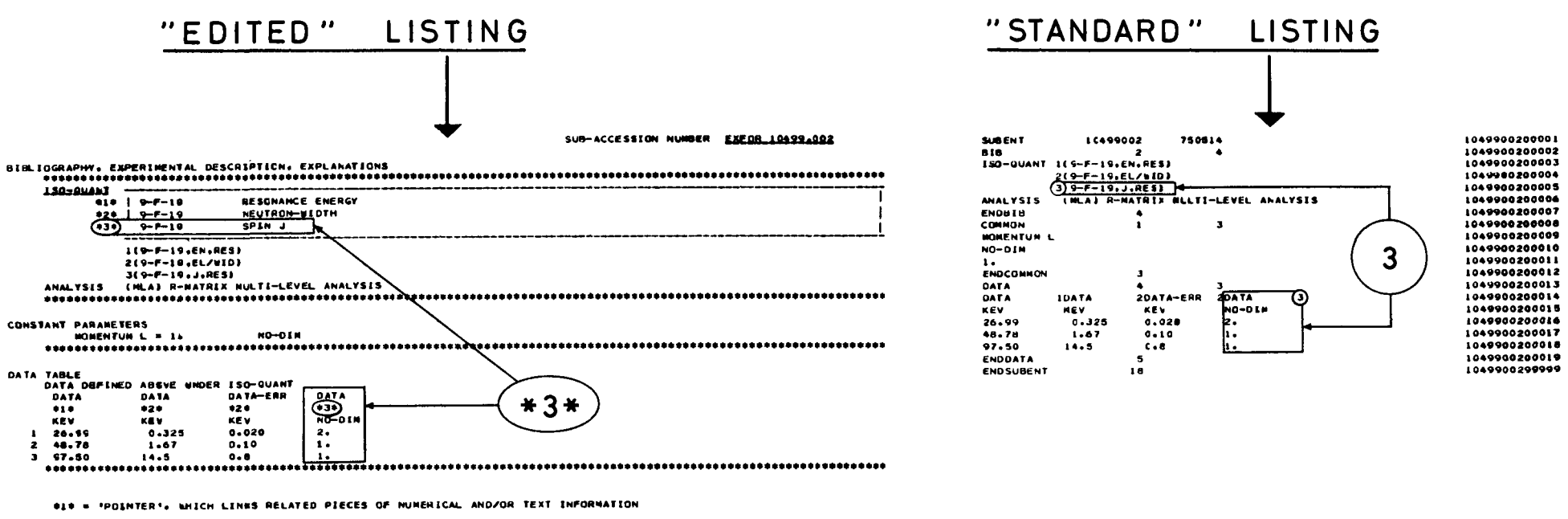
2

IN THIS EXAMPLE, A POINTER LINKS AN ANGLE AND THE CORRESPONDING DIFFERENTIAL CROSS - SECTION.
ALSO NOTE THAT TABLES WITH MORE THAN 6 COLUMNS WHICH ARE TEDIOUS TO DECIPHER IN "STANDARD" FORMAT, ARE CLEARLY PRESENTED IN THE "EDITED" LISTING.

LIST OF DATA-HEADING KEYWORDS

KEYWORD	EXPLANATION
EN	INCIDENT NEUTRON ENERGY, LAB-SYSTEM
EN-APRX	APPROXIMATE VALUE OF INCIDENT NEUTRON ENERGY
EN-CM	INCIDENT NEUTRON ENERGY, C-M-SYSTEM
EN-MIN	LOW LIMIT OF INCIDENT N-ENERGY RANGE, LAB-SYSTEM
EN-CM-MIN	LOW LIMIT OF INCIDENT N-ENERGY RANGE, C-M-SYSTEM
EN-MAX	HIGH LIMIT OF INCIDENT N-ENERGY RANGE, LAB-SYSTEM
EN-CM-MAX	HIGH LIMIT OF INCIDENT N-ENERGY RANGE, C-M-SYSTEM
EN-DUMMY	DUMMY ENERGY, USED AS THE NUMERICAL EQUIVALENT OF AN INCIDENT NEUTRON SPECTRUM WHERE NO NUMERICAL ENERGY VALUE IS GIVEN BY THE AUTHOR
EN-RSL	INCIDENT-NEUTRON ENERGY-RESOLUTION
+EN-RSL	+UNSYMMETRIC ENERGY RESOLUTION
-EN-RSL	-UNSYMMETRIC ENERGY RESOLUTION
EN-ERR	ERROR OF MONOCHROMATIC INCIDENT-NEUTRON ENERGY OR UNCERTAINTY OF THE CENTRAL ENERGY IN AN INCIDENT NEUTRON-SPECTRUM.
EN-ERR1	ENERGY ERROR, IF MORE THAN ONE ERROR IS GIVEN. EXPLANATION UNDER 'ERR-ANALYS'.
EN-ERR2	SECOND ENERGY ERROR, IF MORE THAN ONE ERROR IS GIVEN. EXPLANATION UNDER 'ERR-ANALYS'
+EN-ERR	+ UNSYMMETRIC ENERGY-ERROR
-EN-ERR	- UNSYMMETRIC ENERGY-ERROR
EN-NRM	NORMALIZATION ENERGY. TO BE USED WHEN A DATA SET IS NORMALIZED TO ONE ENERGY ONLY.
EN-RES	RESONANCE ENERGY
EN-RES-ERR	ERROR OF RESONANCE-ENERGY
NU-ADLER	NU IN ADLER-ADLER RESONANCE-ANALYSIS, EQUIVALENT TO RESONANCE ENERGY
E	ENERGY OF OUTGOING PARTICLE, LAB-SYSTEM
E1	ENERGY OF OUTGOING PARTICLE, AS DEFINED IN BIB-SECTION
E2	ENERGY OF OUTGOING PARTICLE, AS DEFINED IN BIB-SECTION
E-APRX	
E-CM	ENERGY OF OUTGOING PARTICLE, C-M-SYSTEM
E-MIN	LOW LIMIT OF OUTGOING-PARTICLE E-RANGE, LAB-SYSTEM
E-CM-MIN	LOW LIMIT OF OUTGOING-PARTICLE E-RANGE, C-M-SYSTEM
E-MAX	HIGH LIMIT OF OUTGOING-PARTICLE E-RANGE, LAB-SYSTEM
E-CM-MAX	HIGH LIMIT OF OUTGOING-PARTICLE E-RANGE, C-M-SYSTEM
E-RSL	OUTGOING-PARTICLE ENERGY-RESOLUTION
E-ERR	OUTGOING-PARTICLE ENERGY-ERROR
E-EXC	EXCITATION-ENERGY
E-EXC-MIN	LOW LIMIT OF EXCITATION-ENERGY
E-EXC-MAX	HIGH LIMIT OF EXCITATION-ENERGY
E-LVL	LEVEL-ENERGY
E-LVL-INI	INITIAL LEVEL OF GAMMA-TRANSITION
E-LVL-FIN	FINAL LEVEL OF GAMMA-TRANSITION
E-LVL-ERR	LEVEL-ENERGY ERROR
E-LVL-MIN	LOW ENERGY-LIMIT OF A DISCRETE LEVEL-GROUP
E-LVL-MAX	HIGH ENERGY-LIMIT OF A DISCRETE LEVEL-GROUP
LVL-NUMB	LEVEL-NUMBER, TO BE USED ONLY IF OTHER INFORMATION IS NOT AVAILABLE.
Q-VAL-APRX	APPROXIMATE Q-VALUE
Q-VAL	Q-VALUE
Q-VAL-RSL	Q-VALUE RESOLUTION
Q-VAL-ERR	Q-VALUE ERROR
Q-VAL-MIN	LOWER LIMIT OF Q-VALUE
Q-VAL-MAX	UPPER LIMIT OF Q-VALUE
E-GAIN	GAIN IN NEUTRON ENERGY
E-GAIN-ERR	ERROR OF GAIN IN NEUTRON ENERGY
E-DGD	DEGREDATION IN NEUTRON ENERGY
E-DGD-ERR	ERROR OF DEGREDATION IN NEUTRON ENERGY
ANG	ANGLE, LAB-SYSTEM
ANG1	ANGLE, DEFINITION SPECIFIED IN THE BIB-SECTION
ANG2	ANGLE, DEFINITION SPECIFIED IN THE BIB-SECTION
ANG3	ANGLE, DEFINITION SPECIFIED IN THE BIB-SECTION
ANG-CM	ANGLE, C-M-SYSTEM
ANG-MIN	LOW LIMIT OF ANGLE RANGE, LAB-SYSTEM
ANG-CM-MIN	LOW LIMIT OF ANGLE RANGE, C-M-SYSTEM
ANG-MAX	HIGH LIMIT OF ANGLE RANGE, LAB-SYSTEM
ANG-CM-MAX	HIGH LIMIT OF ANGLE RANGE, C-M-SYSTEM
ANG-RSL	ANGULAR RESOLUTION
ANG-ERR	ANGLE-ERROR
COS	COSINE OF ANGLE, LAB-SYSTEM
COS-CM	COSINE OF ANGLE, C-M-SYSTEM
COS-MIN	LOW LIMIT OF COSINE-RANGE OF ANGLE, LAB-SYSTEM
COS-CM-MIN	LOW LIMIT OF COSINE-RANGE OF ANGLE, C-M-SYSTEM

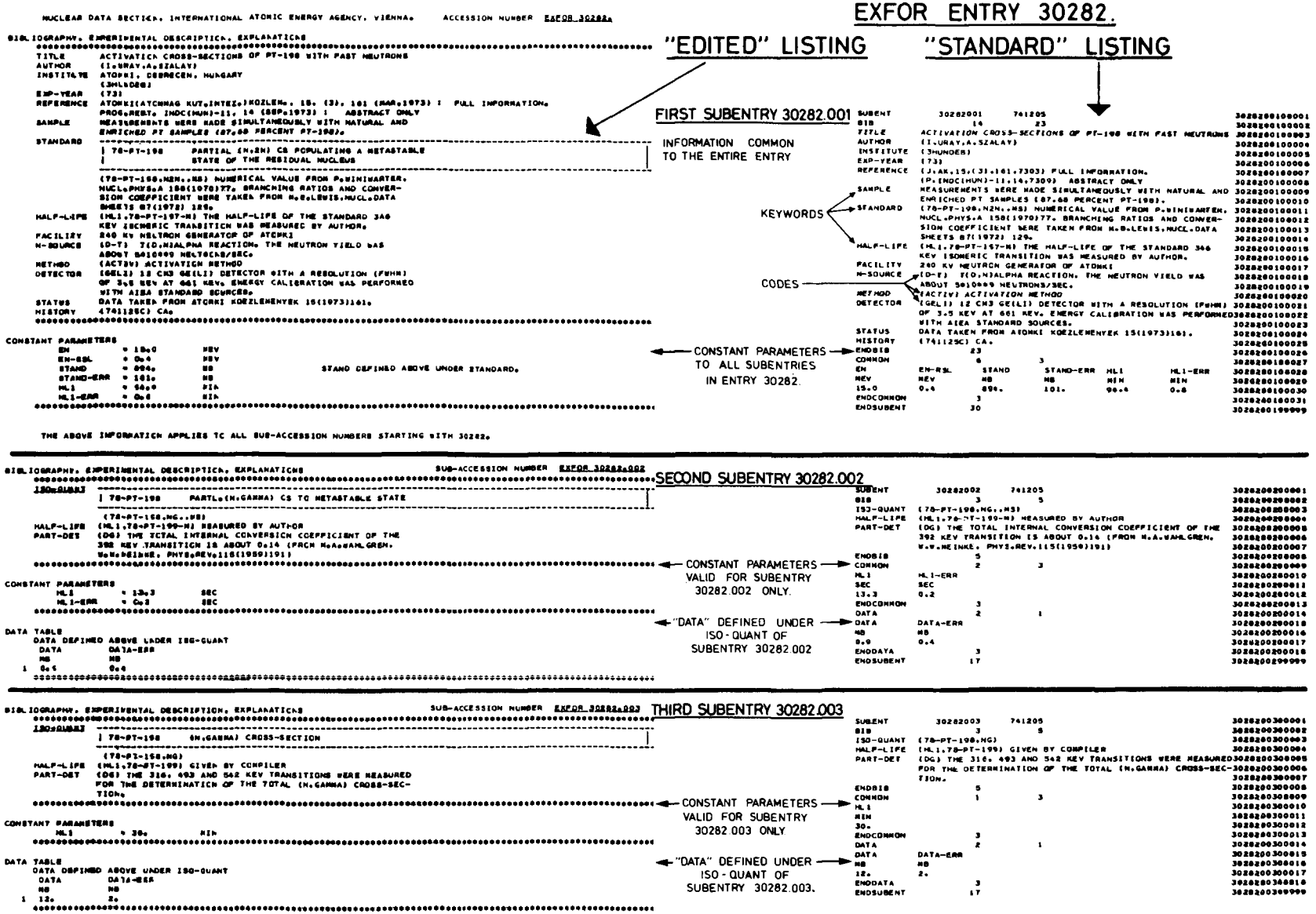
KEYWORD (cont'd)	EXPLANATION (cont'd)
COS-MAX	HIGH LIMIT OF COSINE-RANGE OF ANGLE, LAB-SYSTEM
COS-CM-MAX	HIGH LIMIT OF COSINE-RANGE OF ANGLE, C-M-SYSTEM
COS-RSL	COSINE OF ANGULAR RESOLUTION
COS-ERR	COSINE OF ANGLE-ERROR
DATA	HEADING FOR COLUMN GIVING THE QUANTITY SPECIFIED UNDER 'ISO-QUANT'
DATA-CM	DATA GIVEN IN THE CENTRE OF MASS SYSTEM
DATA-APRX	APPROXIMATE VALUE OF DATUM
DATA-MIN	LOW LIMIT OF DATUM
DATA-MAX	HIGH LIMIT OF DATUM
DATA-ERR	DATA-ERROR, EXPLANATION TO BE GIVEN UNDER 'ERR-ANALYS'
DATA-ERR1	FIRST DATA-ERROR, IF MORE THAN ONE ERROR-COL IS GIVEN. EXPLANATION UNDER 'ERR-ANALYS'
DATA-ERR2	SECOND DATA-ERROR, IF MORE THAN ONE ERROR-COL IS GIVEN. EXPLANATION UNDER 'ERR-ANALYS'
DATA-ERR3	THIRD DATA-ERROR, IF MORE THAN ONE ERROR-COL IS GIVEN. EXPLANATION UNDER 'ERR-ANALYS'
+DATA-ERR	+ UNSYMMETRIC DATA-ERROR, EXPLANATN UNDER 'ERR-ANALYS'
-DATA-ERR	- UNSYMMETRIC DATA-ERROR, EXPLANATN UNDER 'ERR-ANALYS'
RATIO	HEADING FOR COLUMN GIVING THE RATIO SPECIFIED UNDER 'ISO-QUANT', OR THE QUANTITY/STANDARD RATIO
RATIO-MIN	LOW LIMIT OF RATIO
RATIO-MAX	HIGH LIMIT OF RATIO
RATIO-ERR	RATIO-ERROR
RATIO-ERR1	FIRST RATIO-ERROR, IF MORE THAN ONE RATIO-ERROR IS GIVEN. EXPLANATION UNDER 'ERR-ANALYS'
RATIO-ERR2	SECOND RATIO-ERROR, IF MORE THAN ONE RATIO-ERROR IS GIVEN. EXPLANATION UNDER 'ERR-ANALYS'
+RATIO-ERR	+UNSYMMETRIC RATIO-ERROR, EXPLANATN UNDER 'ERR-ANALYS'
-RATIO-ERR	-UNSYMMETRIC RATIO-ERROR, EXPLANATN UNDER 'ERR-ANALYS'
STAND	HEADING FOR COLUMN GIVING THE NUMERICAL VALUE ASSUMED FOR THE ISO-QUANT SPECIFIED UNDER 'STANDARD'
STAND-ERR	STANDARD-ERROR
STAND1	FIRST STANDARD-VALUE IF MORE THAN ONE IS GIVEN. EXPLANATION UNDER 'STANDARD'
STAND2	SECOND STANDARD-VALUE IF MORE THAN ONE IS GIVEN. EXPLANATION UNDER 'STANDARD'
STAND3	THIRD STANDARD-VALUE IF MORE THAN ONE IS GIVEN. EXPLANATION UNDER 'STANDARD'
STAND1-ERR	ERROR OF FIRST STANDARD-VALUE
STAND2-ERR	ERROR OF SECOND STANDARD-VALUE
STAND3-ERR	ERROR OF THIRD STANDARD-VALUE
TEMP	SAMPLE TEMPERATURE
TEMP-ERR	ERROR OF SAMPLE TEMPERATURE
ELEMENT	Z-NUMBER OF ELEMENTS, FOR FISSION-PRODUCT YIELDS ONLY
MASS	A-NUMBER OF ISOTOPES, FOR FISSION-PRODUCT YIELDS ONLY
HL	HALF-LIFE OF RESIDUAL NUCLEUS
HL1	HALF-LIFE OF NUCLEUS SPECIFIED IN THE BIB-SECTION
HL2	HALF-LIFE OF NUCLEUS SPECIFIED IN THE BIB-SECTION
HL3	HALF-LIFE OF NUCLEUS SPECIFIED IN THE BIB-SECTION
HL-ERR	ERROR OF HALF-LIFE OF RESIDUAL NUCLEUS
HL1-ERR	ERROR OF HALF-LIFE OF NUCLEUS SPECIFIED IN BIB-SECTION
HL2-ERR	ERROR OF HALF-LIFE OF NUCLEUS SPECIFIED IN BIB-SECTION
HL3-ERR	ERROR OF HALF-LIFE OF NUCLEUS SPECIFIED IN BIB-SECTION
FLAG	FLAG, MEANING OF FLAGS GIVEN UNDER THIS HEADING TO BE EXPLAINED IN BIB-SECTION UNDER 'FLAG'
NUMBER	COEFFICIENT-NUMBER OF LEGENDRE OR COSINE COEFFICIENTS
NUMBER-CM	COEFFICIENT-NUMBER OF LEGENDRE OR COSINE COEFFICIENYS WHEN THE FIT HAS BEEN DEDUCED FROM AN ANGULAR DISTRIBUTION IN WHICH THE ENERGIES ARE GIVEN IN THE CENTRE OF MASS SYSTEM
SPIN J	SPIN J OF RESONANCES, STRENGTH-FUNCTIONS, ETC.
MOMENTUM L	ANGULAR MOMENTUM L OF RESONANCES, STRENGTH-F'S, ETC.
PARITY	PARITY OF RESONANCE
STAT-W G	STATISTICAL-WEIGHT FACTOR G
MOM	LINEAR MOMENTUM OF INCOMING PARTICLES
MOM-MIN	MINIMUM LINEAR MOMENTUM OF INCOMING PARTICLES
MOM-MAX	MAXIMUM LINEAR MOMENTUM OF INCOMING PARTICLES
MISC	HEADING FOR A COLUMN WITH SUPPLEMENTARY INFORMATION FOR WHICH NO DATA-HEADING KEYWORD HAS BEEN DEFINED. EXPLANATION TO BE GIVEN UNDER 'MISC-COL' KEYWORD
MISC1	FIRST MISCELLANEOUS COLUMN - IF MORE THAN ONE IS GIVEN SAME USAGE AS -MISC-(SEE ABOVE)
MISC2	SECOND MISCELLANEOUS COLUMN -IF MORE THAN ONE IS GIVEN SAME USAGE AS -MISC-(SEE ABOVE)



POINTERS LINK RELATED PIECES OF NUMERICAL AND/OR TEXT INFORMATION. IN THIS EXAMPLE, A POINTER (E.G. 3) LINKS AN ISO-QUANT WITH ITS CORRESPONDING DATA COLUMN.

EXAMPLE 1

EXFOR ENTRY 30282.



There are several categories of numerical data:

- In the DATA TABLE the numerical data of the quantity defined above under ISO-QUANT are given under DATA (or RATIO) together with the columns of independent variables, errors, etc.

- Constant numerical values which are common to the entire data table of a given subentry, are given in the CONSTANT PARAMETERS (also called COMMON in the standard format) section.

- Constant numerical values which are common to all subentries of a given entry, are given in the CONSTANT PARAMETERS (resp. COMMON) section of the first subentry of that entry.

All numerical data are defined by Data-heading keywords (e.g. DATA, EN = incident neutron energy, STAND = standard) and by Data-unit keywords (e.g. EV, MB). The list of Data-heading keywords presently used is given on page 6.

Some data tables may have a more complex structure, for example there may be several ISO-QUANT per subentry; in this case each ISO-QUANT is connected to its pertinent column in the DATA TABLE by means of a "pointer", as illustrated in example 2. More generally a pointer can be used to connect related pieces of information (see example 3).