International Atomic Energy Agency INDC(NDS)-63/L

INDC INTERNATIONAL NUCLEAR DATA COMMITTEE

REPORT OF THE NUCLEAR DATA SECTION TO THE INTERNATIONAL NUCLEAR DATA COMMITTEE SEPTEMBER 1973 TO AUGUST 1974

August 1974

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

INDC(NDS)-63/L

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A. INTRODUCTION

Between September 1973 and August 1974 NDS experienced the following change in staff: Francisco Manero (Spain) left NDS end of August 1973 and could unfortunately only be replaced in mid-September 1974 by Munib Adel Khalil (Iraq). He will be responsible for CINDU, data compilation and request work. Alex Lorenz (US) rejoined the Section and has taken over from Leif Hjaerne the "non-neutron" nuclear data programme. As deputy head of the Section he also assists in its administration. Charles Dunford left the Section in May 1974, his responsibilities have been distributed to other staff in the Section. Peter Smith (Canada) joined the Section in November 1973 on the post formerly held by Trevor Byer. He is responsible for WRENDA and assists in EXFOR programming. Meinhart Lammer (Austria) who is responsible for CINDA compilation and acted as scientific secretary of the Panel on Fission Product Nuclear Data at Bologna, will leave the Section at the end of September 1974 and be replaced by his wife Traudl Lammer. Ruben Yaghubian (Iran) joined the Section in August 1974 for five months to assist in data compilation. Eva Kiovsky (Austria), senior secretary of the Section since its beginning left the Agency in August 1974 and has been replaced by Helga Feiler (Austria). Claudia Manica (Italy) has replaced Cheryl Wilson (US) as data preparation clerk.

The high rate of turn-over in staff this year and an additional gap of about 1.5 professional manyears caused unfortunate delays in several of the Section's vital activities.

In the field of neutron nuclear data most of the Section's operations have become well established. The CINDA 73 supplement and CINDA 74 were published on schedule. For this first time, CINDA 74 serves as an index to the EXFOR data exchanged up to March 74 and to selected evaluated data. EXFOR compilation and transmission to the other centres proceeded smoothly, although at a reduced rate, due to delays in staff recruitment. At the Tenth Meeting of the Four Neutron Data Centres in Paris in May 1974 agreement was reached on the last major issue in the development of EXFOR, i.e. the coding of multi-dimensional data. Dissemination of evaluated neutron nuclear data in the centre's service area increased by a factor two compared to the last reporting period 72/73.

In the field of "non-neutron" nuclear data the major events were the two meetings on charged particle and photonuclear reaction data and on nuclear (structure and decay) data for applications in April/May 1974. Both meetings were attended by representatives of most of the major data centres and groups and were successful in developing the necessary framework for the implementation of an international system for the compilation, evaluation, exchange and dissemination of nuclear structure, decay and reaction data.

A nuclear data use questionnaire has been developed which will be distributed to a representative fraction of the nuclear community in the Agency's Member States; it is designed to determine the needs for nuclear data compilations and evaluations and improved user services in the various fields of science and technology.

Initially the role of NDS in the field of "non-neutron" nuclear data will be mainly that of an information office having the responsibilities to disseminate information on data activities and availability and to assist in the coordination of data compilation and exchange. Subject to the overall development of nuclear data research and use, the implementation of these and other foreseeable responsibilities can be anticipated to require a commensurate expansion of the Section's total manpower in the years to come.

The Panel on Fission Product Nuclear Data (FPND) which NDS held at Bologna in November 1973 was a major organisational and scientific success with considerable impact on the activities of the community of measurers, evaluators and users of FPND. It was attended by more than 60 participants from 17 countries and three international organisations. Application, requirements, status and testing of FPND were comprehensively reviewed and a number of activities initiated which shall be reviewed at a similar Panel in about three years time.

Most of the WRENDA computer programmes have been written and are by now operating. WRENDA 74 was issued in spring this year in the new format. A first request list for Nuclear Data for Fusion was published in December 1973 and a revised Request List for Sageguards Nuclear Data is under preparation.

The Targets and Samples Programme is now established as a continuous Agency Programme. First steps were taken to develop bilateral cooperation between East Asian countries in the measurement of required nuclear data. A small cooperative research programme has been started. Period of broadening scope of NDS involving five different laboratories to measure the $^{103}Rh(n,n')^{103m}Rh$ reaction important for reactor neutron dosimetry.

A Handbook was published in August 1974 containing neutron, charged particle and photonuclear cross sections important for activation analysis. The NDS review work of reactor neutron dosimetry cross sections is nearing completion. A comprehensive report on the third IAEA review of thermal fissile nuclear data has been drafted and is now being discussed with the co-authors involved.

In summary, this and last year's progress reports of NDS to the INDC reflect the increased needs for data centre services as a result of the growth of the nuclear data user community and their requirements. In view of this increased demand upon its services and the restricted size of its manpower, NDS has had to limit its programme during the pasttwo years. If in the years to come NDS is to continue and improve its services to the nuclear data community, serious consideration will have to be given to careful selection of its activities including an eventual expansion of its staff.

B. INDC SECRETARIAT

B.1. Liaison Officers

The following changes in the membership of INDC Liaison Officers have occured in the course of this reporting period:
Drs. I. Slaus and G. Ricabarra, after completing their term on the Committee, have re-assumed their Liaison Officer status; after the appointment of the new INDC members from Hungary and the Netherlands, the status of the Liaison Officers for these two countries has been maintained, primarily because the two representatives from each of these countries reflect the interests of the neutron and non-neutron data communit es respectively.

Following its admission as IAEA Member State, the German Democratic Republic has been invited to appoint a Liaison Officer.
Liaison Officers have been replaced in the following countries:

Austria:	Professor P. Weinzierl by Dr. O.J. Eder from SGAE Seibersdorf;
Denmark:	Dr. H.B. Moeller by Dr. C.J. Christensen from Risoe;
Uruguay:	Prof. H. Buenafama by Prof. A. Lalanne from Montevideo
Pakistan:	Dr. A. Ghani by Dr. A.M. Khan from the Pakistan Institute of Nuclear Science and Technology

The current list of INDC Liaison Officers to the INDC comprizes scientists from 38 countries, and is given in Appendix A.

As in previous years, progress reports submitted by countries not directly represented on INDC, have been compiled into two consolidated reports: one for those countries which are in the NDS service area, the other for those outside the NDS service area. The two reports are INDC(SEC)-42/L and INDC(SEC)-43/L.

In the course of this reporting period, the Liaison Officers have been requested by the INDC secretariat to respond to a number of querries which were initiated at the last INDC meeting. The following information was requested: membership composition of existing national nuclear data

committees, description of available nuclear experimental facilities, comments on the usefulness of CINDA, and suggestions about possible nuclear structure and nuclear models study which could be performed at the International Centre for Theoretical Physics at Trieste. The Liaison Officers were also asked whether they could assist in the distribution of the Nuclear Data Questionnaire in their countries. The replies to these querries and their contributions are considered in more detail under the pertinent titles.

B.2. List of Correspondents

In an effort to bring the INDC List of Correspondents up-to-date, all INDC Members and Liaison Officers were requested last December to submit to the secretariat the latest changes, additions, and deletions pertinent to the distribution lists of their countries. The result of this last up-date, the first major one since 1971, has been published in the usual format and distributed as INDC(SEC)-39/U in June 1974. The next issue of this list will be published in November 1974.

In view of the expansion of the scope of INDC activities to include non-neutron nuclear data, the number of correspondents, whose interest will differ from the existing neutron data oriented correspondents, is expected to increase considerably. In order to ensure that this expansion is properly reflected in the established practices of the INDC Secretariat regarding the maintenance of the list of correspondents and the distribution of documents, the INDC is asked to review this situation, and to consider the changes proposed in a working paper which will be submitted separately.

B.3 Documents Distribution

The current list of INDC documents received and distributed by NDS/INDC Secretariat has been published as INDC(SEC)-41/U in July 1974. A supplement will be distributed in November 1974.

As stated under section B.2. above, the INDC is asked to review the current document distribution practices in the light of the expansion of the scope of the Committees activities, and consider the changes proposed in the forthcoming working paper referred to under B.2.

To alleviate the IAEA costs for the distribution of INDC documents, the INDC secretariat would like to inquire into the possibility of distributing INDC documents from local distribution points in larger countries. The pre-addressed documents would be shipped in bulk from IAEA to the local

distribution points. This mode of distribution would only be pertinent to larger countries having many INDC correspondents (e.g. USA, USSR, India, Japan...)

B.4. Translation of Documents

During the past year, the INDC Secretariat has received a number of Soviet documents in Russian. As a result of the large number of reports received and the size of most of these reports, the translation and the typing of the translations have suffered considerable delay. Because of the excessive work-load that the translation of Soviet nuclear data reports imposes upon the IAEA translation facilities, the "Nuclear Constants" series (formerly called "Information Bulletin of the Nuclear Data Centre, Obninsk"), of which volumes 4 through 9 have been translated by the IAEA, can no longer be translated by the IAEA. The "Nuclear Physics Research in the USSR - Collected Abstracts" report series will continue to be translated by the IAEA on a regular basis.

In order to maintain an adequate distribution of the "Nuclear Constants" report series, it is requested of the appropriate authorities in the USSR to supply to the INDC Secretariat the necessary number of copies of the original reports so as to be able to give them a full "G" distribution.

The question of the translation of nuclear data documents by the IAEA was also raised at the Tenth Four-Centres Meeting (Paris, 1974), where it was suggested that the pertinent authorities responsible for the publication of Soviet nuclear data reports consider attaching English language abstracts and keywords to all reports, and provide as far as possible, complete English translations of important nuclear data documents. As a result of this suggestion it was agreed that CJD would investigate the possibility of including abstracts in English to articles in Jadernye Konstanty (Nuclear Constants) or to send them to the IAEA for translation, and provide number links between the abstracts and the Bulletin (i.e. Nuclear Constants report) articles. Inclusion of English keywords using the Nuclear Data Project system would also be considered. (See action 4 in section II.1, page 4 of the Report on the Tenth Four-Centres Meeting to be published as INDC(NDS)-58/G).

The Soviet reports received by the INDC Secretariat during this reporting period (September 1973 - August 1974) are listed below; their status as of August 1974 is indicated in the right-hand column.

INDC(CCP)-34	Programme of the Second All-Union Conference on Neutron Physics Kiev, USSR, 28 May - 1 June 1973	Table of Contents Translated Distributed
INDC(CCP)-35	Nuclear Physics Research in the USSR - Collected Abstracts Volume 15	Received 8 Oct. 1973 (in translation)
INDC(CCP)-36	Nuclear Physics Research in the USSR - Collected Abstracts Volume 16	Received 8 Oct. 1973 (in translation)
INDC(CCP)-37	Problems of measuring Nuclear Constants for Thermonuclear Reactors, by E.A. Kuzmin et al. (translated by H.G. Dalby, LASL)	Received (May 1973) Distributed
INDC(CCP)-38	Nuclear Constants, Vol. 8, Part 1	Received March 1973 (full translation) (in publication)
INDC(CCP)-39	Nuclear Constants, Vol. 8, Part 2	Received March 1973 (partial translation) Published July 1974
INDC(CCP)-40	Nuclear Constants, Vol. 8, Part 3	Received March 1973 (Table of Contents transl.) Published July 1974)
INDC(CCP)-41	Nuclear Constants, Vol. 8, Part 4	Received March 1973 (Table of Contents transl.) Published July 1974
INDC(CCP)-42	Nuclear Constants, Vol. 9	Received March 1973 (in publication)
INDC(CCP)-43	Nuclear Constants, Vol. 7	Received Oct. 72 (in publication)
INDC(CCP)-44	Compendium of Selected Soviet Reports on Nuclear Data	(in publication)

B.5. Facilities List

Upon the recommendation of the INDC at its last meeting (see action 29) the NDS/INDC Secretariat has initiated the compilation of existing nuclear experimental facilities in developing or smaller countries. Inasmuch as this proposed compilation was acknowledged by other sections within the IAEA to have a broad potential usefulness for other Agency programmes, the NDS decided to organize this new facilities' list as a computerized data base using a standard in-house (IAEA) computer programme. The advantages offered by having this data base computerized are: easy extension of data base in scope and/or depth, ease of sorting and selective retrievals, convenient output publication format. The standard output of the facilities list will be ordered by Country/Institute/Facility type; each facility, having a unique descriptor, will be described on one or two pages of continues text (see sample output for one facility in Appendix B). Indexes in the back of the list will allow for simple look-up cross-reference. The first version of the Facilities List Data Base, including all known experimental facilities in the NDS service area will be published in the form of an INDC(SEC) report during the second half of 1974. Updates of the Facilities List will be published as need arises.

B.6. Compilation of National Nuclear Data Committees

Upon the recommendation of the INDC at its last Meeting (see actions 2 and 3), the INDC Secretariat requested from all INDC Members and Liaison Officers a membership list of all existing national nuclear data committees. The information received in response has been compiled into a single report INDC(SEC)-40/L, which has been distributed in July 1974.

In view of the noticeable appearance of national nuclear data committees in a number of countries, and the resultant introduction of a number of new individuals in the field of nuclear data, the INDC members and Liaison Officers are urged to ascertain that all pertinent members of those committees be included in the list of INDC correspondents (see B.2. above).

C. MEETINGS

C.1. Past Meetings

C.1.1. Consultants' Meeting on Nuclear Data for Reactor Dosimetry Vienna, 10-12 September 1973

The Nuclear Data Section convened a Consultants' Meeting on Nuclear Data for Reactor Dosimetry at the Agency's Headquarters from 10-12 September 1973. In recent years the interest and advances in reactor neutron dosimetry have increased rapidly due to its keyrole in the evaluation and prediction of radiation damage in fast reactors, and for other purposes.

The meeting was attended by nine scientists representing six countries and two international organizations. The papers presented at the meeting have been published as an INDC document (INDC(NDS)-56/U) with a wide distribution to interested scientists. This document also contains the full set of conclusions and recommendations emanating from the meeting. Its agenda is attached as Appendix C.

Results

The consultants' meeting recommended that an internationally accepted, internally consistent file of evaluated neutron cross sections for reactions of interest to reactor neutron dosimetry be established. The "Conclusions and Recommendations" describe in some detail the content and justification for this file and the methods for obtaining it. The reference file of evaluated neutron dosimetry data would be recommended for use in the Agency's Member States.

A set of high priority reactions known as Category I reactions was enumerated. These reactions should be included in any initial data file. It was recommended that the new United States ENDF/B Dosimetry File be used as the basis for the international data file and that an international cooperative effort be undertaken to improve the file.

New measurements of the energy dependent cross sections for the Category I reactions should be undertaken where data is missing or discrepant (especially for neutron energies from 6-13 MeV). However, it was recognized that all the data required could not be measured on a time scale compatible with fast reactor development needs. Therefore results of integral measurements from well defined benchmark experiments should be used to adjust the Category I data for internal consistency and to provide the necessary data files for the other less important reactions (Category II).

The Consultants' Meeting considered that international cooperation in the effort to develop a reference file of neutron dosimetry cross sections is essential. Towards this goal, they urged that the relevant information about integral experiments and their results and evaluated neutron data files be given unrestricted international distribution as is the case now for experimental neutron cross sections. The IAEA and its Nuclear Data Section were asked to act as the focal point for this international cooperative effort.

C.1.2. IAEA Panel on Fission Product Nuclear Data, Bologna, 26-30 November 1973

I. Scope, preparation and organization of the meeting

Following a recommendation by the INDC and upon invitation of the C.N.E.N. of the Italian Government IAEA/NDS held the Panel on Fission Product Nuclear Data (FPND) at the Centro di Calcolo of C.N.E.N. at Bologna. The local organization of the meeting was excellently coordinated by Professor Benzi and coworkers from the Centro di Calcolo. Due to a generous financial contribution by the Italian Government it was possible to pay travel and attendance of 16 speakers invited to the meeting. The Panel assumed the unusual size of a small symposium: about 60 scientists from 17 Member States and three international organizations participated in it, thus illustrating the importance and size of national efforts which are being spent on FPND research at the present time.

As unusual as its size was the planning and organization of this panel meeting; its overall success may justify recommending to follow similar procedures in other scientific meetings of the Agency.

First, a small Consultants' Meeting was convened at IAEA Headquarters in Vienna in December 1972 which had the task to determine the objectives, programme and organization of the Panel. The work of this meeting was supported by prior evaluation of positive responses to a world-wide distributed NDS questionnaire on the potential usefulness and scope of such a Panel.

As a result of this meeting, the main objective of the Panel was fixed to arrive at a comprehensive survey of the applications, the status and the testing of FPND and to evaluate the requirements for further measurement and evaluation work. (see last year's NDS report to the INDC, INDC(NDS)-53/L, sections C.1.3. and C.2.2.)

Thereafter, in order to meet this target, with the help of INDC Members and Liaison Officers expert scientists were selected from a number of countries who were asked by the Agency well in advance of the meeting to prepare review papers on 17 prespecified topics comprizing the various aspects of FPND data measurement, compilation and evaluation, their application and their testing. The experts incorporated in their work contributions and opinions from many other scientists all over the world. All these efforts finally resulted in 17 internationally coordinated comprehensive review papers which were mostly distributed to participants before the meeting and served as a basis for its discussions. The essential advantage of this procedure was that, prior to the meeting, every participant was given full information on the subjects of the meeting with the consequence, that the oral presentation of the review papers could be shortened considerably and restricted to the important high lights and that the discussions could be concentrated on deliberations of future work required.

While in various countries task forces and groups exist who work on the compilation and evaluation of FPND in close contact with FPND users, this meeting succeeded in gathering users and producers of FPND, for the first time on an international scale, and in achieving a comprehensive review of the requirements, status and availability of FPND important for various fields of nuclear research and technology such as

- nuclear power reactor design and operation;
- nuclear reactor safety (e.g. afterheat problem);
- nuclear fuel cycle and its environmental problems;
- safeguards techniques;
- life sciences, agriculture and industrial technologies.

The scope of FPND considered by the Panel encompassed

- fission yields;
- beta and gamma decay data;
- delayed neutron data;
- neutron reaction cross sections.

The Proceedings of the Panel will consist of the following two parts:

Part I: Invited review papers (2 volumes)

Part II: Selected contributions to review papers (1 volume)

All three volumes will be published as IAEA Technical Reports and will hopefully come out at the end of 1974.

Six subgroups on various topics were formed during the Panel meeting with the task to summarize the conclusions and recommendations that emerged from the Panel's discussions. The draft reports of these subgroups are now being completed by the Panel's scientific secretaries M. Lammer and J.J. Schmidt as a separate INDC report, after final approval by all Panel participants.

II. Main recommendations

The most important recommendations issued by the Panel are summarized below:

1. A list of existing compilations and evaluations of FPND should be kept up-to-date and published in annual intervals by NEA/CCDN (= Centre de Compilation des Données Neutroniques).

2. International technical information newsletters on FPND, one on evaluated data and discrepancies and one on measurements in progress or completed, should be published regularly by IAEA/NDS.

3. An international request list for FPND measurements should be developed, subject to discussion and approval by the INDC, and published by IAEA/NDS.

4. In order to avoid proliferation of computer formats the American ENDF/B format is recommended to be adopted for the exchange of FPND information.

5. Benchmark experiments on fission product decay heat released after reactor shut-down including testing of the available FPND evaluated data libraries should be internationally coordinated by IAEA/NDS.

6. The Panel identified in detail further FPND measurements required to satisfy user needs. It also recommended a thorough re-investigation of the various user needs in the light of the available data information including studies of the sensitivity of calculated technical parameters to uncertainties in FPND. As a first step, a comparison of FPND status and needs has been performed by the Panel and afterwards, which will be included in the form of appendices to the Panel's conclusions and recommendations.

7. A follow-up panel should be convened in about three years, i.e. in the fall of 1976, with the task to review the progress in FPND measurement and evaluation initiated by the present meeting.

Appendix D contains the programme of the Panel.

C.1.3. IAEA Consultants' Meeting on Charged Particle and Photonuclear Reaction Data, Vienna, 24-26 April 1974

In view of the current and future needs for charged particle and photonuclear reaction data, NDS convened a Consultants' Meeting on Charged Particle and Photonuclear Reaction Data. Considering that the compilation and evaluation of these types of data, which, to date, have been accomplished mainly on an individual or national basis, would be usefully enhanced by establishing a truly international cooperation for the maximum benefit of a growing community of users, the main goals achieved by the meeting were to:

- briefly outline the general scope of the data needs;
- review the present activities of existing centres and groups;
- formulate policy guide-lines that the IAEA will submit to national authorities for implementation.

The following specialists in the field of nuclear data compilation and evaluation took part in the meeting:

E.G. Fuller	(Photonuclear Data Center, Washington, USA),
D.J. Horen	(Nuclear Data Project, Oak Ridge, USA),
F.E. Chukreev	(Nuclear Data Centre, I.V. Kurchatov Inst. Moscow),
H. Muenzel	(Charged Particle Nuclear Data Group, Karlsruhe, FRG),
D. Brune	(A.B. Atomenergi, Sweden)
F. Froehner	(NEA Neutron Data Compilation Center, Saclay, France),
S. Pearlstein	(National Neutron Cross Section Centre, Brookhaven, USA)

The Summary Report of this meeting, including its Conclusions and Recommendations, has been published as INDC(NDS)-59. Reports contributed to the meeting are published separately in INDC(NDS)-61.

C.1.4. Specialists' Meeting on Nuclear Data for Applications, Vienna, 29 April - 3 May 1974

Following the recommendation of the International Nuclear Data Committee the IAEA Nuclear Data Section convened the Specialists' Meeting on Nuclear Data for Applications, with the object to work out the necessary measures for an extended international cooperation in the compilation, evaluation, exchange and dissemination of nuclear structure and decay data used in science and technology.

The meeting was attended by 14 participants and 9 observers, representing the major data centres dealing with the compilation and evaluation of nuclear structure and decay data, as well as measurers and users of these data.

The participants recognized that the short- and long-term requirements of the community of nuclear structure and decay data users cannot be met satisfactorily by the existing nuclear data compilation and evaluation centres, or by the existing methods of nuclear data dissemination. They considered the means by which the existing compilation and evaluation efforts could be extended, and drafted a set of policy recommendations which are designed to form the basis of an international cooperative system for the compilation, evaluation and dissemination of nuclear structure and decay data.

The Summary Report of this meeting, including its conclusions and recommendations, has been published as INDC(NDS)-60. Reports contributed to the meeting are published separately in INDC(NDS)-61.

C.1.5. NDS Participation in other Meetings

C.1.5.1. Fourth International CODATA Conference Tsakhcadzor, Armenian SSR, 24-27 June 1974

CODATA Conferences, held every other year, serve as a forum for the interchange of information on the use of data in science and technology, and for the establishment of closer scientific contacts among scientists concerned with the compilation, evaluation and dissemination of numerical data.

Topics emphasized during the Fourth CODATA Conference were: modus-operandi of disciplinary and mission-oriented data centres, interaction and cooperation between data centres, interaction of data centres with data producers and users, computer usage in data systems organizations, progress in data handling of atomic, molecular, nuclear, spectroscopic and thermophysical data,

and the determination of CODATA's role in meeting the data needs for the cosmic, geo- and bio-sciences. All papers submitted to the Conference will be published by CODATA. A complete list of papers presented at the meeting is given in the Conference programme (see Appendix E).

The meeting offered an opportunity to relate the role and objectives of the IAEA/NDS nuclear data programme to a broad inter-disciplinary audience and to exchange information on the operation of data centres. A paper by Dr. L.N. Usachev described the operation of the Soviet Nuclear Data Centre (CJD) at Obninsk, in context of international cooperation in the field of neutron data exchange.

C.1.5.2. 35th Meeting of the EURATOM Working Group on Reactor Dosimetry (EWGRD), Brussels, 14-15 March 1974

The main purposes for the participation of NDS in this meeting were:

a) to report on the present status of nuclear data for reactor neutron dosimetry, especially on the discrepancy between the set of fission neutron spectrum averaged cross sections recommended by Fabry from Mol, Belgium, and new results from Prof. Kimura's group at Kyoto University, Osaka, Japan;

b) to discuss the present status of knowledge of the 14 MeV values for standard neutron dosimetry reactions;

c) to report on the joint effort of the Nuclear Data Section and the Seibersdorf Laboratory to coordinate (and to assist in) measurements of $^{103}Rh(n,n')\ ^{103}Rh^{m}$ cross sections initiated at several laboratories in South Africa, Brazil, Belgium and EURATOM;

d) to discuss the inclusion of the EWGRD request list for data for reactor neutron dosimetry applications in WRENDA 74; this list was discussed in detail and its final version approved by the meeting.

e) to clarify the status of benchmark facilities and experiments (standard neutron fields) and their use in the future in accordance with the recommendations of the Agency's Consultants' Meeting on Nuclear Data for Reactor Neutron Dosimetry, Vienna, September 1973 (see C.1.1.)

The role of benchmark experiments for the improvement of nuclear data for reactor neutron dosimetry was stressed by Dr. Fabry (Mol, Belgium), who presented two important reports relevant to this problem. Dr. Sanders (Winfrith, UK) also presented a report about the standard neutron field facility NISUS, developed at the Imperial College in London. Other benchmark facilities in some European countries and in the USA were mentioned during the meeting, and the growing interest in benchmark measurements was stressed (see also section C.2.5.).

Of special interest for the Agency was the proposal of Dr. Serpan (USA)[+] to convene an International Symposium on Neutron Dosimetry and Spectrum Analysis for Materials Applications sponsored by ASTM* and EURATOM. Prof. Farinelli asked NDS to investigate the possibility of Agency participation in this Symposium.

C.1.5.3. Second International Symposium on Neutron Capture Gamma Ray Spectroscopy and Related Topics, Petten, Netherlands, 2-6 September 1974

The Symposium will be attended by J.R. Lemley of the Nuclear Data Section. The program is closely related to the NDS's responsibilities for compiling and disseminating neutron data, including capture gamma ray data, within its service area. Since some questions concerning compilation of neutron capture gamma ray spectra remain unresolved, this Meeting provides a unique opportunity to discuss developments with leading experts in the field. The preliminary program is attached.

C.1.5.4. International Symposium on Neutron Induced Reactions, Smolenice, Czechoslovakia, 2-6 September 1974

This Symposium is organized by the Institute of Physics of the Slovak Academy of Sciences, Bratislava. Its programme was developed by an advisory committee composed of East and West European experts in the field and covers the following main topics:

- neutron induced reactions;
- reaction mechanismus;
- experimental techniques;
- future of fast neutron studies and applications.

Attendance will be mostly from East European countries. This will give A. Calamand, who will attend for the Nuclear Data Section, a good opportunity to renew contacts with East European neutron nuclear physicists. He will in particular give a talk on nuclear data services of NDS.

[+] Dr. Serpan is Chairman of the Agency's International Working Group on Reactor Radiation Measurements.

* ASTM = American Society for Testing of Materials.

C.2. Future Meetings

C.2.1. IAEA Advisory Group Meeting on Transactinium Isotope Nuclear Data, fall 1975

NDS plans to convene an Advisory Group meeting on Transactinium Nuclear Data (TND) in the fall of 1975 (presumably November) with the co-sponsorship of NEA. The place and exact date of the meeting remain to be fixed in cooperation with NEA.

The objectives and organisation of the meeting are outlined in Appendix G. To ensure that the goals of the meeting be successfully met, it will be organized in the same way as the panel on Fission Product Nuclear Data, held in Bologna, Italy, 26-30 November 1973 (see section C.1.2.). Internationally coordinated review papers distributed to the participants prior to the meeting will provide the background for the discussions.

NDS informed INDC Members and Liaison Officers in detail about the nature of this meeting and asked them to name suitable experts for preparing, and contributing to, review papers. On the basis of the received replies reviewers and contributors to reviews will be selected shortly and official invitations for the meeting sent out.

C.2.2. IAEA Consultants' Meeting on the Use of Nuclear Theory in Neutron Nuclear Data Evaluation, late fall 1975

In recent years the use of nuclear theory with appropriate parameterization has gained increasing importance for neutron nuclear data evaluation and has become successful in the smooth fitting of measured data, in providing data in energy gaps of experimental data, particularly also for nuclei, where measurements are not (yet) feasible.

So far this subject has not been reviewed by a separate meeting NDS is therefore intending to convene a Consultants' Meeting on this subject in the late fall of 1975. Originally it was foreseen to hold the meeting towards the end of 1974 or in the beginning of 1975; however, according to the 1974/75 overall schedule of NDS meetings and to the manpower and financial means available, the meeting had to be postponed. The meeting should bring together mainly neutron nuclear data evaluators and nuclear theorists interested in the development of nuclear models and theories with a view of their practical applications. In accord with the INDC recommendation to seek the collaboration of the Agency's Trieste Centre for Theoretical Physics for the development of nuclear models and theories for neutron nuclear data evaluation, the Centre will be invited to participate in the meeting. On 19 February 1974 a letter was sent to INDC participants outlining proposed topics for the meeting and asking for comments.

On the basis of the comments received, also from the EANDC Meeting in Tokyo in March 1974, and in view of the limited size of a Consultants' Meeting, it is proposed, that the meeting restrict its discussions to several well selected topics under the following four main headings:

1. Status of nuclear theory for prediction and evaluation of neutron nuclear reaction data;

2. Systematics of nuclear model parameters;

3. Application of recent theoretical developments to practical evaluation problems;

4. Possibilities for future international cooperation in the development of nuclear models and theories for neutron nuclear data evaluation.

The meeting should critically review theoretical methods (excluding resonance theory) and their accuracies with an emphasis on the statistical model and on coupled-channel optical model calculations. The standardization of the various nuclear codes and procedures will also have to be discussed. Within the context of nuclear models it will be necessary to look at the systematics of important nuclear parameters such as level densities (also recommended by the FPND panel at Bologna, November 1973), $\langle \Gamma_\gamma \rangle$, fission widths, optical model well parameters etc. It will be also important to review future efforts and the implementation of new methods which would be covered in the third topic.

Further advice by the INDC at its 7th meeting will be welcomed and all suggestions be taken into account when formulating the meeting's programme before the end of 1974.

C.2.3. IAEA Study Group Meeting on Nuclear Data Requirements for Shielding

In January 1974 the NEA-CRP recommended that a joint NEA and IAEA sponsored meeting on sensitivity studies for shielding calculations be postponed due to slower-than-anticipated progress and that it should be combined with another meeting on nuclear data requirements for shielding which was scheduled for summer 1975.

In June 1974 NEA and IAEA agreed that a study-group meeting should be held during September 1975 in Bournemouth, UK. During the NEA-CRP meeting in June several members strongly recommended that the agenda be limited to methodology and results (if available) of sensitivity studies, that nuclear data requirements be excluded, and that measurers and evaluators of nuclear

data should not be encouraged to attend. It was additionally recommended that shielding benchmark results should also be included.

As an action arising from the NEA-CRP Meeting a draft agenda, presumably reflecting these opinions, will be circulated by C.G. Campbell from AEE Winfrith, UK and will be reviewed by the Agency's Reactor Physics Section and the NDS. If it is finally decided that nuclear data requirements will be excluded, the NDS will not assist in the organization and sponsorship of the meeting.

C.2.4. Future IAEA Meetings on the Compilation, Evaluation and Dissemination of "Non-neutron " Nuclear Data

The two meetings on "non-neutron" nuclear data *, held in Spring 1974, recommended that the IAEA/NDS, dependent upon the response of the national authorities concerned to the conclusions and recommendations ** convene future meetings necessary for the implementation of the proposed international system of compilation, evaluation and dissemination of "non-neutron" nuclear data. These follow-up meetings, as envisaged at the present time, will be smaller specialists' meetings concerned with specific technical aspects of organization and coordination of the proposed international cooperation. Eventually, these meetings could evolve into periodic meetings of the pertinent data centre representatives, of the type convened by the four neutron data centres.

Listed in the order of their importance and logical sequence, the following topics are suggested as titles for future meetings on "non-neutron" nuclear data:

1. Consideration and adoption of a common bibliographic keyword and reference system.

2. Adoption of common exchange formats for compiled "non-neutron" nuclear data: reaction data, structure and decay data.

3. Compilation and evaluation of nuclear data, their coordination and their contribution to the international effort.

4. Consideration of all aspects of an international file of evaluated nuclear data.

5. Mechanism for the dissemination of "non-neutron" nuclear data to the users.

6. In-depth evaluation, their common evaluation rules and coordination.

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* See sections C.1.3. and C.1.4. of this report

** See reports INDC(NDS)-59 and INDC(NDS)-60

C.2.5. IAEA Consultants' Meeting on Integral Cross Section Measurements in Standard Neutron Fields for Reactor Dosimetry, 1975 or 1976

Benchmark Experiments for Reactor Neutron Dosimetry Cross Sections

During the IAEA Consultants' Meeting on Nuclear Data for Reactor Neutron Dosimetry (see C.1.1) the importance of integral cross section measurements in benchmark neutron fields was stressed by some of the participants (Prof. U. Farinelli, Dr. W. McElroy, Dr. A. Fabry). The role of benchmark facilities for improving reactor neutron dosimetry data was also emphasized at the 35th Meeting of the EURATOM Working Group for Reactor Dosimetry (Brussels, March 1974) and some results of such type measurements were reported (see C.1.5.2.).

A set of benchmark facilities which covers the total energy range of interest was identified and collected at this meeting (see INDC(NDS)-56/U, page 125). These benchmarks were selected so that their spectral characterization is based on refined methods such as neutron spectrometry and detailed reactor physics calculations. In accordance with the proposal of the Consultants' Meeting many important reactions for reactor neutron dosimetry (CATEGORY II) should be measured relative to a few reactions with a very well known cross section (CATEGORY I). In such a way energy dependent cross sections may be adjusted by a correlation scheme using precise integral measurements in a set of benchmark spectra.

Cooperation of many laboratories is essential because the measurement of excitation functions often demands the use of practically all types of benchmark neutron spectra to cover a complete energy range.

On the basis of these considerations NDS is planning to convene in 1975 or 1976 a Consultants' Meeting on Integral Cross Section Measurements in Standard Neutron Fields for Reactor Dosimetry. The meeting should aim at clarifying the following questions:

- Which standard neutron fields (benchmark facilities) are available and, do they cover the energy range of interest for reactor neutron dosimetry?
- How well are the neutron spectra of these benchmarks known and how consistent are they among each other?
- Are measurements of standard neutron reactions consistent in different benchmark neutron spectra?
- What is the accuracy with which unknown cross sections can be determined through the application of benchmarks?
- What reactions important for reactor neutron dosimetry should be measured in such benchmarks?

The Agency's Division for Nuclear Power and Reactors intends to convene the next meeting of the International Working Group for Reactor Radiation Measurements (IWGRRM) in Vienna from 18-20 November 1974. The subject of neutron cross sections and related data for reactor neutron dosimetry and their testing in benchmark facilities was one of the continuing fields of activity of this working group. It is therefore suggested that the IWGRRM discuss at its November meeting in detail the feasibility of the proposed NDS Consultants' Meeting and in addition the programme, time, place, possible participants and modes of preparation of this meeting.

Comments by INDC on this meeting are very welcomed.

C.2.6. Follow-up IAEA Meeting on Fission Product Nuclear Data, fall 1976

The Panel on Fission Product Nuclear Data (FPND) held at Bologna, Italy 26-30 November 1973 (see section C.1.2.), recommended a follow-up meeting on FPND to be held in the fall of 1976. The main purpose of this follow-up meeting will be to review the actions stimulated by the first FPND Panel, and the progress achieved in the meantime.

Discussion topics should again be covered by review papers providing background information and saving discussion time. Surveys of user requirements of FPND should be completed and distributed to reviewers of the status of FPND well in advance of the follow-up meeting, so as to give the status reviewers sufficient time to prepare lists of uncertainties for the required FPND.

C.2.7. Proposed Third IAEA Advisory Group Meeting on Nuclear Standard Reference Data, fall 1976

INDC Recommendation

At its 6th meeting in 1973, the INDC recommended that the next Agency-sponsored meeting on nuclear standards be held in late 1976 rather than in 1975. The subject matter was expected to include non-neutron and non-energy-related standards as well as neutron standards. The size of the meeting was to be adjusted as necessary to accommodate the expanded scope.

Suggested Extensions of Scope

In addition to the acknowledged neutron standards, the following topics have been suggested for the agenda of a meeting on nuclear standards. Comment by the INDC is requested.

1. Gamma-ray standards. A practical application of these standards is calibration of the energy-scales and efficiencies of gamma-ray detectors.

2. Standards for Reactor Dosimetry. The foil activation technique using sandwich detectors and unfolding techniques is commonly used to measure neutron spectra over a wide energy range. The required cross section data have in many cases been measured relative to certain commonly used standard cross sections. In radiation damage and materials evaluation studies for both fission and fusion reactors, determination of 14-MeV neutron fluences are often based on certain standard cross sections.

   a. At the Consultants' Meeting on Nuclear Data for Reactor Neutron Dosimetry, Vienna, 10-12 September 1973, the participants designated a set of 14 Category I reactions which were "not necessarily chosen with respect to their practical importance or priority for actual routine dosimetry, but rather with the aim of improving dosimetry cross section data files". [1] Of these 14 reactions, four are already among the recognized neutron standard reference data, although not necessarily in the energy range where they are commonly used as standards. These reactions have been suggested for inclusion in the agenda of a meeting on nuclear standards.

   b. Integral measurements in standard (benchmark) neutron fields are being used to generate a set of potentially consistent cross section data for reactor dosimetry applications. The standard neutron fields have been characterized by measurements with spectrometers based on standard reactions - $^{6}Li(n,\alpha)T$, $^{3}He(n,p)T$, hydrogen scattering, by theoretical calculations and by comparison with large sets of differential cross section data. The importance of $^{6}Li(n,\alpha)T$ as a dosimetry standard is frequently overlooked, especially in the energy range 1.5-5 MeV, where there are few alternative standards. Use of the $^{6}Li(n,\alpha)T$ as a standard above 500 KeV should be included in the discussion.

Size and Budget

The two previous meetings on neutron standard reference data have been panels. Provisionally the third meeting has been scheduled in the budget for 1976. For the final Agency approval, a definite confirmation of the former INDC recommendation will be required from the Seventh INDC Meeting. As the Agency funds for such a meeting are restricted, it will be essential for the success of the Panel, particularly in view of its enlarged scope, that a number of experts attending be paid by their home countries. INDC Members are asked to use their influence to this effect.

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[1] Proceedings, INDC(NDS)-56, p. 127.

C.2.8. IAEA Symposium on Research Materials for Nuclear Measurements, 1976

At its last meeting INDC endorsed this Symposium and expressed its support for the intended cooperation between the Agency's Nuclear Data and Industrial Applications and Chemistry Sections in the preparation of the Symposium, subject to the approval by the Agency's Scientific Advisory Committee (SAC) (see INDC-14/L, Appendix III6, page 101, see also p. 84f and Appendix XXVII, page 152).

This Symposium, approved by SAC for 1975, has been deferred to 1976. It is expected to be co-sponsored by EURATOM and to be held in Geel or Brussels.

C.2.9. Third IAEA Conference on Nuclear Data, 1977 or 1978

INDC is asked to discuss the feasibility of a Third IAEA Conference on Nuclear Data, to be held in 1977 or 1978 and to give advice to the Agency in this respect.

The conclusion of the last INDC Meeting was to postpone the Conference until 1977 to avoid overlap with the two large nuclear data conferences in 1975 in the USA and the USSR and to convene instead specialist meetings to review status and requirements in new application fields (see INDC-14/L, page 84 and Appendix III.5, page 100). Inasmuch as the USA and the USSR in the past held nuclear data conferences in cycles of 2-3 years and possibly will be interested to continue to do so, it might be worthwile to take up again the proposal B. Rose put forward at the last meeting to i.e. to synchronize the nuclear data conferences so that a conference is organized every year successively by the USA, the USSR and the IAEA. In this context it would be of interest to learn from the US and USSR INDC Members about plans in their countries concerning nuclear data conferences in 1977 or 1978. The answer to the question regarding the feasibility of an IAEA Conference with a strongly widened scope compared to the first two nuclear data conferences in Paris and Helsinki will also depend on the experiences with the two 1975 Conferences in the USA and the USSR.

Should it come to a discussion of the programme of this Conference at the Seventh INDC meeting, the attention of INDC participants is drawn to the Aide-Memoire by P. Ribon on the Meeting of the Programme Committee for this Conference in Paris on 25 November 1972 and on a Revised Preliminary Program Proposal by C. Dunford prepared after the Programme Committee Meeting. Both documents are being sent together to INDC participants under separate cover.

D. REQUEST LISTS AND TARGETS AND SAMPLES

D.1. WRENDA: 1974 publication and future programme

The WRENDA 74 edition of the World Request List for Nuclear Data was published as INDC(SEC)-38/U in April. WRENDA 74 contains 1190 requests for nuclear data measurements for fission reactors for 632 data types from 21 countries and one international organization. Despite having only a short period for review of requests most countries submitted revised request lists. The most extensive changes to the request list came from countries in the CCDN service area.

The WRENDA status file was completely rewritten by NDS so that only recently completed experiments and experiments in progress were mentioned.

Other request lists (see also D.2. and D.3.)

During 1974 the fusion and safeguards data measurement requests were encoded in WRENDA format by NDS from their previous publications (INDC(NDS)-50/U and -57/U). Revisions were made to the fusion request file as a result of the recent publication of the UK Request List, and a few new French and West German requests were added. The safeguards request file was revised for a new list from Japan and revised requests from the Fed. Rep. of Germany and the USSR.

Future Developments

In his report to the 10th Meeting of the Four Neutron Data Centres in Paris, 6-10 May 74, C. Dunford made several suggestions as to improving the procedures for reviewing and updating the various request lists. The report was accepted and has been forwarded to INDC participants (NDS Working Paper 4 to the 7th INDC Meeting) for discussing and taking decisions on the following points:

1. If the INDC should endorse a policy of considering all requests from a country not responding to NDS request for a review of their WRENDA entries for two successive years as withdrawn.

2. Should a better review method than the "country retrieval" be adopted? Several countries did not use the country retrieval reports submitted to them for review.

3. If the INDC would endorse a simple system for the request "status" flag, restricting it to the categories no flag, revised or new. The determination of the appropriate request "status" flag was often impossible with the information supplied

by the countries. In particular, the distinction between satisfied and withdrawn requests has not been consistently maintained.

All pertinent countries have been approached to revise their former requests and/or to submit new ones for inclusion in WRENDA 75. The deadline for receipt by NDS of these requests is 1 February 1975.

D.2. Nuclear data request list for fusion

Status of the request list

The Request Lists of Nuclear Data Requirements for Controlled Fusion Research as submitted to the IAEA by Member States were published and distributed in December 1973 as INDC(NDS)-57/U+F. When the new WRENDA system became operational, fusion requests were coded in WRENDA format by C.L. Dunford and P.M. Smith. Updating, selective retrieval and preparation for publication can now be done quickly and routinely.

Since December 1973 revisions to the requests have been received from the UK. Publication of a revised request list should be considered by INDC.

Need for improved priority assignments

The fusion request list indicated the types of data which may eventually become important in fusion research and reactor design. However, at present the list is not a useful guide for justification and support of nuclear data programs because it does not contain consistent priority assignments, because it is unstable with respect to materials and reactions for which data are requested, and because in general the requests have not received thorough status reviews.

Opportunities for use of the list in guiding and funding of nuclear data programs are becoming increasingly frequent. Data measurement and compilation programs are often partially justified by reference to fusion applications. The Nuclear Data Section, for example, would find the request list useful in reviewing research proposals, in administering the Targets and Samples Program, in planning meetings and in organizing its own data compilation, evaluation and review activities. It also has opportunity to advise developing countries about potentially useful programs which could be undertaken with their nuclear research facilities.

Similar applications for a request list must already exist in Member States which have extensive fusion and nuclear research programs. If the request list is to serve the needs of the research community, it will be increasing-

ly necessary to face the problem of proper priorities and accuracy requirements for nuclear data for fusion applications. As these priorities become better defined, they should be incorporated in the data request list. Recommendations to achieve these goals are requested from INDC.

International Fusion Research Council (IFRC) Meeting

In May 1974 the IFRC met in Vienna. Nuclear data requirements were discussed briefly. Although no major programs in the field of nuclear data were recommended, IFRC members expressed desire to cooperate closely with the Agency, the INDC and the nuclear data organizations in their own countries. To facilitate cooperation, the NDS is currently preparing a list of names of IFRC members, INDC members, national nuclear data committee chairmen and requestors whose names appear in nuclear data request lists for fusion.

D.3. Nuclear data request list for safeguards

The last published document concerning the World Safeguards Request List is the report INDC(NDS)-50; it was issued in March 1973 and contains the following:

- an American List
- a Soviet List
- a German List

At the last INDC meeting in October 1973, a Japanese request list was presented. Revised German and Soviet lists were received in May and July 74 respectively (after the deadline of 1 April 1974 requested at the 6th INDC Meeting, see INDC-14/L, Appendix VII, page 108) and were merged into the file which has now been encoded in the WRENDA format.

NDS plans to publish a new edition of the World Safeguards Request List, end of 1974 or early 1975, and would appreciate it if the national lists could be checked at, or soon after, the INDC meeting (country retrievals are available for an easier check). For good order and consistency sake, NDS would also appreciate the feasibility of merging into the World Safeguards Request List the British and French safeguards requests which are presently in the WRENDA file.

D.4. Targets and samples programme summary

The Targets and Samples Programme has been accepted as a continuing programme of the Agency. The 1975 Programme will be announced in summer 1974.

Status summary

Funding for the 1974 Programme is $ 17 000. A status summary by country follows.

Bangladesh - Requests from M. Islam for natural U, U-235 and Pu-239.

The natural U and Pu-239 samples have been ordered from CBMN Geel. U-235 would have to be released by the USAEC; procurement is still under consideration.

Brazil - Requests from Mafra-Guidicini for Np-237.

Strong support for proposed (γ,n) and (γ,f) measurements was received from reviewers in Sweden and the USA. A formal bid has not yet been received from CBMN. Due to high probable cost ($ 10 000) it may be necessary to split the budgeting between the 1974 and 1975 Programme. Official Government support has been received.

India - Request from Gupta for Au-197.

No further reply has been received since the initial informal contact.

Pakistan - Requests from groups at Pinstech, Rawalpindi.

All have official Governmental support.

a) Pu-240, 241, 242 for fission studies. Bids from CBNM are still outstanding. Isotopes of Cm, Bk and Cf were also requested, and availability is still under investigation.

b) Enriched In-115, Te-126, Sr-88, Ni-58 for fast-neutron cross section measurements. These materials are prohibitively expensive. Possibility to obtain them on loan from the Harwell pool at 5% of value for six-months period is being investigated.

c) Graphite single crystals for neutron monochromator. No decision about support has been made.

d) Nd-150 for structure studies by (n,γ) measurements. Samples for similar work were supplied under the 1972 Programme. No decision about support has been made.

Romania -

a) Gd-156, 157, 158 and Ba-134, 135, 136 for (α,n) measurements. No (α,n) requests appear in WRENDA, so probability of support is low.

b) Request from Baicu for U samples of various enrichments for studies of delayed gamma-ray yields in photofission. The proposal is being reviewed. The justification is for safeguards.

c) Requests from Calboreanu for U-233, 235 and Pu-239 and for U samples of various enrichments for studies of fission gamma spectra. Proposal is being reviewed.

d) Request from Corcalciuc for tritium targets for total, elastic and inelastic cross section measurements. Under consideration.

Yugoslavia - Request from Cvelbar for spherical Sc sample to supplement those samples supplied in the 1972 programme.

The sample has been ordered from CBNM.

Return of Materials

Under the Targets and Samples Programme materials are loaned by the Agency to the Member States. It is anticipated that some samples will be returned in the near future. Arrangements must be made for determining the condition of the samples and for storage of those which the Agency owns. Availability for loan of the returned materials must also be made known in the Member States.

Suggestions of the INDC are invited. Participation by the Agency in the Harwell Stable Isotope Loan Scheme might enable the Agency to recover some of the costs of the Programme and might be an effective means to publicize availability of returned materials. Some Agency-owned samples will be radioactive, however.

Acknowledgements

The advice of experts at CBNM, Geel, has frequently been sought concerning the availability and costs of materials. Such advice, as well as fabrication of many samples, has greatly facilitated operation of the Programme.

Individual members of the INDC have been extremely cooperative in arranging, when necessary, for expert review of proposals which accompany requests for targets or samples.

D.5. Nuclear data measurements in East Asian countries

NDS activities have so far concentrated on exploring possibilities for bilateral cooperation in the measurement of nuclear data requested in WRENDA lists by countries in East Asia. The intention is to incorporate nuclear data measurements as one item in the broader scope of a programme on Regional Co-operative Agreements for Research, Development and Training Related to Nuclear Science and Technology which the Agency's Department of Research and Isotopes is currently pursuing for countries in East Asia.

Following action 28 of the 6th INDC Meeting NDS extracted groups of measurement requests according to specific data type or application from WRENDA and distributed this information in a memorandum dated 25 October 1973 to all INDC participants including the members of the "Ad-hoc Subcommittee on measurement programmes in developing countries". Similar information including a brief summary on nuclear data facilities and research in several East Asian countries was provided to Professor Glubrecht, Deputy Director, IAEA Department of Research and Isotopes, for his travel to East Asian countries in the fall of 1973, for first discussions with the nuclear authorities concerned (see memo sent to INDC participants on 8 November 1973).

Both memoranda were specially sent to the INDC Members of India and Japan and the INDC Liaison Officers of Bangladesh and Korea with the objective to enquire the possibilities for bilateral cooperation (India/Bangladesh, Japan/Korea) in the measurement of nuclear data requested in WRENDA. The responses from all four countries were in principle positive although rather general. In Japan particularly JAERI and the Research Reactor Institute of the Kyoto University at Kumatori near Osaka would be willing to accept young scientists from the Korea Atomic Energy Research Institute, Seoul, for nuclear data work at their accelerator and reactor facilities, if travel and subsistence expenses could be borne by the IAEA. Between Bangladesh and India discussions had already been held for collaboration in various programmes; specifically two scientists from the Bangladesh Atomic Energy Centre worked at B.A.R.C. Trombay with the 5.5 MeV Van de Graaff accelerator on capture gamma rays. Thus there seems to exist a basis for collaboration in nuclear data measurements particularly between the Saha and B.A.R.C. Institutes in India and the Bangladesh Atomic Energy Centre.

In this context it should also be noted that facilities to do nuclear data measurements are available in the countries concerned; so no money would have to be spent in this respect.

In response NDS explained the primary objective of such regional cooperation which should be to develop local expertise which can later be applied to national and regional projects in the utilization of nuclear energy. At the same time nuclear data measurements such as requested in WRENDA would be beneficial to both developed and developing countries. NDS hereby tries to stimulate regional support for such measurements in the spirit of the Agency's Regional Cooperative Agreement Programme. The Agency can give only a limited support through the following established programmes:

1. Targets and Samples;
2. Fellowship Programme;
3. Technical Assistance;
4. Research Contracts.

Finally NDS attempts to function as an information centre to assist in bilateral or multilateral arrangements connected with nuclear data (see also memorandum by J.R. Lemley/NDS on regional cooperation in the measurement of nuclear data sent to INDC participants on 29 August 1974).

Following action 29 of the 6th INDC Meeting NDS has started the compilation of a facility list (see section B.5.); such a list is being developed in cooperation with other interested parties in the Agency such as the Chemistry and Physics Sections.

Responding to action 30 A.B. Smith has put forward a 14 MeV differential elastic scattering programme required for controlled thermonuclear research purposes accessible to Cockroft-Walton or Van de Graaff accelerators available in many smaller countries. H. Conde, in a communication to NDS, stressed the training aspect of nuclear data measurements and pointed to Swedish training facilities including nuclear research offered by the annual International Seminars in Physics and Chemistry, Uppsala, Sweden. These seminars cooperate with the IAEA Training Section; students from developing countries can ask for a grant to spend usually 10 months at a Swedish University or institution to perform research in different disciplines.

At the occasion of a visit by Professor Glubrecht, UNESCO, in principle, showed interest in the Agency's programme on nuclear data measurements for training purposes for developing countries; no further response regarding possible financial contributions has been received from UNESCO. It is felt that prior to any further approach to UNESCO the whole matter has to be discussed in much greater detail and plans to be developed in close contact with the parties involved.

At the Agency's General Conference in September 1974 a discussion session has been arranged between national representatives of East Asian Countries and IAEA staff on various subjects of the Agency's Regional Cooperative Agreement Programme (see INFCIRC/167 of 18 August 1972 sent to INDC participants), including nuclear data measurements.

The fact that the 7th INDC Meeting is held in Australia, i.e. in the Far East, gives the opportunity to discuss in technical detail during the INDC Meeting the proposals on nuclear data measurements with the East Asian parties involved. To this effect aside from the INDC Liaison Officer of New Zealand, also the Liaison Officers of Bangladesh and Korea have been invited by the Agency to attend the meeting as observers. After the INDC Meeting, J.J. Schmidt from NDS plans to visit the laboratories concerned in Japan, Korea, Bangladesh, India and Pakistan and explore in further detail the technical feasibilities for bilateral cooperations in nuclear data measurements.

The fact that so far only East Asian countries were approached, due to the fact that Regional Cooperative Agreements were first extended to East Asian countries, does obviously not imply a restriction of the nuclear data measurement programme for smaller countries to this region alone (see e.g. section D.6.).

D.6. Summary of NDS's role in the promotion and coordination of measurements of the $^{103}Rh(n,n')^{103m}Rh$ cross section

Because its 90% response function in the fission neutron spectrum extends to particularly low energies and because of its favorable physical properties, Rh is a particularly desirable material for use in the sandwich-detector technique for unfolding reactor neutron spectra. At the Consultants' Meeting on Nuclear Data for Reactor Dosimetry, convened by the NDS in September 1973, the $^{103}Rh(n,n')^{103m}Rh$ cross section was designated as being of special importance for reactor dosimetry applications and was made a Priority 1 request in WRENDA. Existing data for the $^{103}Rh(n,n')^{103m}Rh$ reactions have been reviewed by M. Vlasov et al. of NDS (see INDC(NDS)-47/L).

As a result of the WRENDA request and the proceedings of the Consultants' Meeting, two laboratories in the NDS service area undertook inelastic scattering cross section measurements on Rh. D. Reitmann at the Atomic Energy Board, Pretoria, South Africa, proposed measurements covering the range 200-1200 keV using a Van de Graaff accelerator and detecting the scattered neutrons. R.A. Douglas at the Institute of Atomic Physics, University of Sao Paulo, Brazil, proposed measurements for energies above 3 MeV using the activation method and a Pelletron accelerator. Partly due to encouragement by NDS, H. Liskien at CBNM, Geel, Belgium, has tentatively planned Rh cross section measurements to begin in 1975.

As a consequence of recently completed work by K.H. Czock, at the IAEA Seibersdorf Laboratory, the Agency offered to provide absolutely calibrated sources of ^{103m}Rh activity (from a longer-lived ^{103}Pd source) for use in absolute measurements of the ^{103m}Rh activity in connection with cross section measurements.

Integral measurements of the $^{103}Rh(n,n')^{103m}Rh$ cross section have been completed by A. Fabri and K.H. Czock using the standard neutron field facility at Mol, Belgium. The data are presently being analyzed and will be published soon. Dr. Czock has also assisted Prof. J. Csikai in verification of absolute activity measurements at the Institute of Experimental Physics of the Kossuth University, Debrecen, Hungary.

With its very limited manpower, the NDS is attempting to generate similar interest in measurement of other nuclear data having important applications in nuclear science and technology.

D.7. IAEA Handbook on Nuclear Activation Cross Sections

Due to the fast progress of activation analysis in the last decade and its wide applications in medicine, environmental control, industry, agriculture etc. the need has arisen among workers in the field for a handbook containing the various types of cross-sections values whose knowledge is required for activation analysis. Such a book should also be of special interest for developing countries where well equipped libraries are generally not available.

Following numerous suggestions from outside users, from Agency meetings and from international surveys of data needs, the Nuclear Data Section has compiled such a handbook, consisting of contributions from outside scientists and NDS staff, which has been published in August 1974 by the IAEA. The contents of this handbook are:

- 2200 m/sec Neutron Activation Cross Sections, by R. Sher, Stanford University, Stanford, California, USA
- Infinite Dilution Resonance Integrals, by H. Albinsson, AB Atomenergi, Studsvik, Sweden
- Tables and Graphs of Cross Sections for (n,p), (n,α) and (n,2n) Reactions in the Energy Region 1 to 37 MeV, by M. Bormann, H. Neuert and W. Scobel, I. Institut f. Experimentalphysik, Universitaet Hamburg, Hamburg, Fed. Rep. of Germany

  Part I: Tables of recommended (n,p), (n,α) and (n,2n) Cross Sections between 13.9 and 15.1 neutron energy

  Part II: Graphs of recommended (n,p), (n,α) and (n,2n) excitation functions between 1 MeV and 37 MeV neutron energy
- Cross Sections for Fission Neutron Spectrum Induced Reactions, by A. Calamand, Nuclear Data Section, IAEA
- Excitation Functions for Charged Particle Induced Nuclear Reactions in Light Elements at Low Projectile Energies, by J. Lorenzen and D. Brune, AB Atomenergi, Studsvik, Sweden
- Photonuclear cross sections, by B. Buelow and B. Forkman, University of Lund and Lund Institute of Technology, Lund, Sweden.

The price of the handbook is US $ 26,- . Note that the price is reduced by 50% if the book is ordered from the Agency through official channels. INDC participants are asked to assist NDS in advertising widely this handbook.

D.8. IAEA Interregional Review Course on Reactor Burn-up Physics, Mol, Belgium, 7-18 October 1974

NDS gave assistance to the Agency's Nuclear Power and Reactor Division in the organisation of suitable lecturers for the part of this review course which is concerned with nuclear data requirements, status and availability for burn-up purposes. The individual topics and the names of the scientists who have agreed to give lectures on these topics are:

1. Cross-section data for fissionable isotopes in both thermal and fast neutron energy regions (F. Kaeppeler, KFZ Karlsruhe, FRG);

2. Availability of data on fission product yields and their dependence on the type of fission (thermal and fast) (A.J. Fudge, Harwell, UK);

3. Decay constants and neutron capture cross sections for fission products;

4. Classification of fission products in different groups (pseudo-fission products) and availability and uncertainty of the corresponding nuclear data;

5. Suitable cross section condensation schemes. (Lecturer for items 3-5: R.J. Heijboer, RCN Petten, Netherlands).

The proceedings of the Review Course will be published by the Agency and particularly the nuclear data lectures be made available to INDC participants.

E. "NON-NEUTRON" NUCLEAR DATA

E.1. Nuclear data use questionnaire

One of the major tasks of the newly formed INDC Subcommittee on Non-Energy Applications of Nuclear Data is to assess the nuclear data requirements for nuclear and atomic data in the non-energy areas of nuclear science and technology. In this connection, Professor Berenyi has suggested that a questionnaire be used to that effect, and submitted to NDS a draft of a questionnaire to be addressed to nuclear data users in the non-energy application fields.

In view of the increasing needs for non-neutron nuclear data also in energy applications, we have given this proposal strong consideration and have suggested to broaden the scope of this investigation, so as to obtain a more comprehensive picture of the overall data needs for the benefit of both INDC subcommittees, that is in the non-energy as well as in the energy application fields. By this, we also hope to avoid the need for an undesirable proliferation of questionnaires to different nuclear data users.

In agreement with Professor Berenyi's intention, we would like to emphasize that the questionnaire is designed primarily to determine the needs for compilations, evaluations, tabulations etc. and improved user services in the area of non-neutron nuclear data; it is not intended to duplicate WRENDA request lists.

The specific objectives of this questionnaire are the following:

- First, it is an attempt to identify the users of nuclear data;
- Second, it is designed to assess the types of data used, and to establish priorities for their requirements;
- Third, it is hoped to receive from the users community an appraisal of the adequacy and availability of existing data.

A proposed draft questionnaire, based on Professor Berenyi's suggestions and the questionnaire of Drs. Muenzel and Michaelis (designed specifically to define data needs in the field of activation analysis), was sent to the INDC and INDC Liaison Officers for their comments and suggestions. The final version of the questionnaire is under preparation and will be ready for distribution during the fourth quarter of 1974.

One important aspect which will ultimately determine the significance of the information collected by this survey is that the questionnaire reach as large a number of nuclear data users as possible. To assist NDS in this task, we

have asked INDC Members and Liaison Officers if they would be in a position to distribute the questionnaire in their countries and to supply NDS with the names and addresses of scientists and engineers to whom the questionnaire should be sent. This assistance will not only help us in the identification of the nuclear data user community, but also alleviate considerably the costs of such a broad survey.

In response to this querry, a number of INDC Correspondents have informed us that they will indeed be prepared to distribute the questionnaire in their countries.

Also, the USSR State Committee on the Utilization of Atomic Energy has informed us that they will be prepared to translate the NDS questionnaire into Russian, distribute it within the Soviet Union, collect the replies and transmit the results to NDS.

E.2. "Non-neutron" Nuclear Data Information Office

One of the recommendations put forward by the participants of the Specialists' Meeting on Nuclear Data for Applications (see section C.1.4. and Summary Report of this meeting published as INDC(NDS)-60), dealt with the establishment of a Central Information Office for the purpose of bridging the nuclear data information gap between the various data centres and groups and the community of "non-neutron" nuclear data users.

The proposed information office would perform the following functions:

- maintain and disseminate a catalogue of existing, projected and required compilations and evaluations,
- maintain a list of existing nuclear data centres, compilers and other experts in nuclear data,
- answer requests from users on the source and availability of nuclear data compilations and evaluations,
- assist in the coordination of the compilation and evaluation effort for the international file of evaluated nuclear data, and
- collect and disseminate information on the needs for nuclear data, with the objective of promoting compilation and evaluation work as need arises.

The recommendation further specified that:

- In order to reach the largest possible fraction of the community of users it would be necessary for this information office to advertise its services through all available channels (e.g. INDC members and liaison officers, professional journals and associations, and national nuclear data committees).

- In order to assure the efficient operation of such an information office, all nuclear data compilation and evaluation centres and groups should communicate to it on a regular basis all developments (i.e. news, innovations, changes, etc.) in the field of nuclear data compilation and evaluation.

- The IAEA should provide for establishing this office within its Nuclear Data Section under the aegis of INDC. The natural location for such an office is believed to be the IAEA Nuclear Data Section because of its connection with a wide variety of nuclear data users associated with IAEA programmes.

In response to this recommendation the NDS is prepared to allocate one man-year during the 1974-1975 reporting period, to initiate the functions described above.

One activity which has already been initiated by NDS in response to this recommendation is the formulation of a Nuclear Data Referral File which is to serve as a general information base to support the information office functions outlined above. The proposed file is to contain information on the existing nuclear data compilations, tabulations and evaluations which have been published. The format and appearance of this file will be similar to the Facilities' List described in section B.5. and shown in Appendix B.

Appropriate excerpts of this file are planned to be merged and published periodically in the form of a catalogue of existing nuclear data compilations and evaluations, and distributed to the nuclear data user community. It is anticipated that the first issue of this catalogue will be ready for distribution during the first half of 1975.

Another activity initiated by NDS this year, which falls within the overall objectives of the proposed information office, although not specified in the recommendations, is the assessment of "non-neutron" nuclear data needs and requirements in the form of the Nuclear Data Use Questionnaire (described in section E.1. above). The results of this survey are also planned to be widely distributed.

E.3. Exchange of "non-neutron" nuclear data information

Concurrent with those efforts initiated by IAEA/NDS in organizing the exchange and dissemination of "non-neutron" nuclear data and associated information several steps have been taken at other places to start the exchange of bibliographic reference material and of the data themselves.

Bibliographic references

In the Soviet Union, both "non-neutron" nuclear data centres, the Nuclear Data Centre at the Ioffe Institute near Leningrad (Dr. I.A. Kondurov, Director) and the Centre for Nuclear Structure and Reaction Data at the Kurchatov Institute in Moscow (Dr. F.E. Chukreev, Director) have adopted the ORNL Nuclear Data Project (NDP) reference and keyword coding system. The data centre at the Kurchatov Institute has completed a compilation of references of Soviet works on nuclear structure and reaction data using the ORNL/NDP keyword system, covering the period of January 1973 to June 1974, which is to be sent this year to ORNL/NDP as an initial trial transmission.

Experimental data

The use of the EXFOR system, which was developed by the four neutron data centres for the exchange of experimental neutron data, has been considered by several centres and groups for the compilation of charged particle nuclear reaction data:

a) The extension of the EXFOR system to "non-neutron" nuclear data has been considered by the four neutron data centres at the last two Four-Centre Meetings in 1973 and 1974 (see section F.3.1. and INDC(NDS)-54/G).

b) Both USSR "non-neutron" nuclear data centres, in Moscow and Leningrad, have expressed their interest to adopt the EXFOR system for "non-neutron" nuclear data.

c) The Charged Particle Nuclear Data Group of the Karlsruhe Nuclear Research Centre in the Federal Republic of Germany headed by Dr. H. Muenzel is currently studying the EXFOR system specifications for coding charged particle nuclear reaction data. In this connection, Dr. Kronenberger from the Karlsruhe center visited NDS for one week in summer 1974 to study the EXFOR system and associated computer programmes.

d) NNCSC has submitted two proposals on the adaptation of EXFOR to the compilation of nuclear structure and reaction data to the two "non-neutron" nuclear data meetings in April/May 1974.

F. NEUTRON DATA CENTRE ACTIVITIES

F.1. NDS area service

F.1.1. Data compilation

After having finished the conversion of old DASTAR data into EXFOR, the EXFOR compilation continued at a somewhat reduced rate.

The coverage of new data was fairly good in the fall of 1973, but due to the lack of manpower a certain backlog has developed since then. Due to budgetary restrictions at the Agency, one post was vacant throughout the reporting period, and for several months two or three posts were vacant, resulting in a continuous shortage of manpower for compilation work.

Consideration has been given to proposals regarding changes in the EXFOR system to allow for more complex (i.e. multi-dimensional)data tables and for non-neutron nuclear data.

F.1.2. Data dissemination and exchange

Experimental data

The exchange of experimental neutron data between the four neutron data centres is performed primarily by means of the EXFOR system (see section F.3.2 Status of EXFOR data exchange). The dissemination of experimental neutron data by NDS is therefore limited primarily to its own service area (i.e. area 3). In the course of the current reporting period, some data were sent to the NEA/CCDN (i.e. area 2) service area in response to specific requests received in conjunction with the data review for the Activation Analysis Handbook (see D.7) and to requests received from Austrian physicists.

In general, the dissemination of experimental neutron data has decreased somewhat in comparison to the last reporting period (1972 - 1973). This is believed to be due primarily to an increase in the availability of evaluated data, requests for which have increased considerably since last year (see Request Statistics and Tables II A and II B below).

Evaluated data

The growing demand for evaluated neutron data in the NDS service area (area 3) has resulted in the dissemination of almost twice the number of evaluated data sets in area 3 during the current reporting period (1973 - 1974) in comparison to the last period (1972 - 1973). The evaluated data dissemination statistics shown in Table II B gives an indication of the overall pattern of evaluated data exchange between the four service areas.

In the course of the current reporting period the following evaluated data were received and made available to customers in the NDS service area:

- a number of new or revised UK-NDL nuclear data library files
- Soviet evaluated data sets from Nikolaev et al. on magnetic tape

- the Lawrence Livermore Laboratory ENDL Library in ENDF/B format

- some additional files of the Bologna library

Request and Dissemination Statistics

The statistics of data requests received and originated by NDS, and of data disseminated during the current reporting period (1973 - 1974) are given in Tables I, II A and II B, organized in the same way as in last year's report.

Table I gives the request statistics, which is organized in three groups: (1) "Incoming" requests received at NDS, (2) "Follow-up" requests, which are initiated when data needed for an "incoming" request are not yet available at the center, (3) "NDS origin" requests which were sent as part of the NDS nuclear data centre activities. Each request group is sub-divided by service area, where area 1 is the NNCSC area (North America), 2 is the NDCC area (West Europe and Japan), 3 is the NDS area and 4 is the CJD area (USSR).

Table II A and IIB give the statistics of data disseminated on request. This excludes the routine exchange of EXFOR data between the centers.

Data requests include requests for experimental data, evaluated data, documents or CINDA retrievals. Most frequent request-types are: "send all existing data on specified reactions", or "send best existing data on specified reactions". All data are requested for data reviews and comparison with own experiment or theory. Best data are requested for applied purposes. Both request-types include experimental and evaluated data, for example: latest evaluated data plus more recent experimental data.

The total number of requests for most data categories and request groups has experienced a normal yearly increase. One exception is a significant drop in the "follow-up" requests to other centres indicating the increased ability of NDS to satisfy incoming requests from its own experimental (EXFOR) and evaluated data files.

TABLE I

SUMMARY OF NDS REQUEST STATISTICS AS OF 31 AUGUST 1974

REQUESTS FOR	EXPERIMENTAL DATA		EVALUATED DATA		DOCUMENTS		CINDA RETRIEVALS		TOTALS	
REQUEST ORIGIN	Cumulative totals	73-74 period	Cumulative totals	73-74 period	Cumulative totals	73-74 period	Cumulative totals	73-74 period	Cumulative totals	73-74 period
Incoming from Area 1	26	1	1	0	49	16	0	0	76	17
" " " 2	42	6	6	2	102	34	1	0	151	43
" " " 3	96	13	74	20	93	19	17	1	280	53
" " " 4	44	0	18	2	14	2	7	0	83	4
Incoming: Subtotal	208	20	99	24	258	71	25	1	590	117
Follow-up to Area 1	66	0	2	1	0	0	0	0	68	1
" " " " 2	65	1	15	0	3	1	21	4	104	5
" " " " 3	51	3	2	0	1	0	0	0	54	3
" " " " 4	32	1	1	0	3	0	0	0	36	1
Follow-up: Subtotal	214	5	20	1	7	1	21	4	262	10
NDS origin: sent to Area 1	27	1	1	0	2	0	0	0	30	1
" " " " " 2	33	2	8	0	4	0	11	3	56	5
" " " " " 3	129	6	0	0	5	4	0	0	134	10
" " " " " 4	13	1	2	0	0	0	0	0	15	1
NDS origin: Subtotal	202	10	11	0	11	4	11	3	235	17
TOTALS:	624	35	130	25	276	76	57	8	1087	144

TABLE II A

Experimental Data Dissemination

(Excluding EXFOR data exchange)

31 August 1974

	Number of data sets		Number of data lines	
	Cumulative total	1Sep-31Aug 1973-1974 period	Cumulative total	1Sep-31Aug 1973-1974 period
To Area 1	2.527	0	68.139	0
To " 2	3.602	127	69.367	1.584
" " 3	4.850	1299	420.169	106.180
" " 4	623	0	160.999	0
Total:	11.602	1.426	718.674	107.764

TABLE II B

Evaluated Data Dissemination

31 August 1974

	Number of data sets		Number of data lines	
	Cumulative total	1Sep-31Aug 1973-1974 period	Cumulative total	1Sep-31Aug. 1973-1974 period
To Area 1	1.172	7	228.099	539
" " 2	1.343	446	252.998	7.041
" " 3	5.771	1.915	2.520.010	769.885
" " 4	1.839	350	813.084	157.477
Total:	10.125	2.718	3.814.191	934.942

F.1.3. Programming activities

The programming of the new WRENDA system was completed on schedule and NDS can provide the services promised to the other centres.

The conversion of all other programme systems to run under the new Operating System is almost completed, including the basic EXFOR system, with some improvements. When this conversion is completed, work will begin on the new internal data index, the "computation format" and improved plotting programmes.

The CINDA data index lines are now automatically extracted from area-3 and area-4 EXFOR tapes.

F.2. CINDA

F.2.1. CINDA compilation and coverage

The NDS Cinda work was hampered somewhat by the fact that some details of the new NDCC Cinda system were not yet perfected. These technical problems were resolved at the May 1974 4-Centres Meeting. The new Cinda system is now in full operation at NEA/NDCC and USAEC/TIC, and the retrieval services were much improved.

The coverage of Cinda in the NDS service area is currently up-to-date and complete.

During the past two years, NDS has pointed out some systematic gaps in the Cinda coverage, in particular of US laboratory reports. The detection of these gaps was appreciated by TIC at Oak Ridge and corresponding entries have since been made.

F.2.2. CINDA publication

CINDA 74 has been published and distributed in the middle of June. The Cinda book includes now about 100 000 entries. Among these are, for the first time, references to EXFOR entries and to some (not yet all) evaluated data libraries in the UK-format. According to previous experiences of the NDS with its CINDU data-index, the indexing of data libraries improves the general awareness of the compiled data and increases the usage of the data-centre services.

The increase of the book volume due to the referencing of data libraries was partially compensated by omitting from the book (though not from the CINDA computer library) some of the superseded progress reports. This action of removing noise from the CINDA book will be continued as manpower permits.

F.2.3. Survey of CINDA Usefulness

Upon the recommendation of the INDC at its last meeting (see Action 17), the INDC Secretariat queried INDC members and Liaison Officers regarding the usefulness of CINDA in their respective countries.

Replies to this survey question were received from eleven correspondents all of them being positive. The texts of their comments are given in Appendix H.

F.3. Inter-Centre activities

F.3.1. Tenth Four-Centre Meeting, Paris, 6 - 10 May 1974

The Tenth Four Centre Meeting, hosted this year by NEA/NDCC, took place at the OECD Headquarter in Paris, 6-10 May 1974. The agenda of the meeting and list of participants is given in Appendix I. The report of the meeting is to be published by NDCC, and will be distributed as INDC(NDS)-58/G.

Parts of the meeting were held in two parallel sessions, one for the centre heads to discuss priorities and future development, and the other for the discussion of technical details among centre representatives.

The principal points of discussion were:

- the implementation of the new WRENDA system (World REquest list for Nuclear DAta measurements), for which the computer programmes were recently written by NDS, The need was recognized that WRENDA-74 (document INDC(SEC)-38) be widely distributed to national research-planning and funding bodies;

- the possible extension of the exchange mechanisms, which were developed successfully for neutron nuclear data, to some categories of non-neutron nuclear data;

- the adoption of a set of new rules by which the EXFOR system (computerized EXchange FORmat for experimental neutron data) is generalized for inclusion of more complex (i.e. multidimensional) data tables and other categories of nuclear reaction data (see INDC(NDS)-58/G for details);

- the discussion and solution of some technical difficulties within the CINDA system (Computer Index of Neutron DAta, compiled by the Four Centers and published by IAEA); these difficulties had arisen from the transition to new computer programmes at NDCC and from the forthcoming transfer of the US CINDA operations from Oak Ridge to Brookhaven;

- some concern was expressed about the insufficient completeness of EXFOR data exchange, due to lack of manpower mainly at NDCC but also at NDS. Data compilation work at NDS had suffered from the fact that, during the past year, NDS lost more than 1 1/2 manyears due to delayed filling of vacant posts.

The next Four-Centre meeting is proposed to take place at NNCSC, Brookhaven National Laboratory, 10 - 14, March 1974, in the week following the Third Nuclear Cross Section and Technology Conference in Washington, D.C. in March 1975.

F.3.2. Status of EXFOR data exchange

The transmission of neutron data by means of the EXFOR system has continued satisfactorily. The following table shows the EXFOR tapes, number of works and number of subworks transmitted by each centre for the period June 1973 to May 1974.

Centre	Number of EXFOR Tapes	Number of new works	No.of revised works,	No.of new subworks,	No. of revised subworks
NNCSC	7	49	6	592	18
CCDN	2	115	0	777	0
NDS	4	36	55	301	168
CJD	2	23	7	234	68

In this table, a "work" means one experiment (reported in one or more publications), from which one or more data tables called "subworks" have been compiled. The term "new" means data transmitted for the first time, and "revised" means revision and retransmissions of data previously transmitted. Such revisions are mostly due to author's revisions or due to additional information extracted from subsequent publications.

The state of completeness of EXFOR appears now to be as follows:

The old SCISRS-1 files containing data from all four areas compiled prior to 1969 which were transmitted by NNCSC to NDS in the years 1972 - 74 have been converted automatically into EXFOR format. The old DASTAR file, containing data from the NDS service area has also been converted into EXFOR. At NDCC, some of the older data in the NEUDADA file from selected laboratories have been converted into EXFOR.

For new data, the EXFOR transmission appears to be fairly complete from NNCSC. For NDCC, compilation of new data is up-to-date, but is in the internal NEUDADA format; efforts are currently being made to convert these data into EXFOR format. EXFOR data compilation and transmission from NDS was fairly complete until the fall of 1973, but was insufficient since then due to lack of man-power (see F.1.1.). Transmission from CJD has steadily improved in quantity and quality.

F.4. Data reviews

F.4.1. Third IAEA evaluation of thermal nuclear data of the main fissile isotopes

A third evaluation of the thermal fissile isotopes constants is currently being performed at NDS, in collaboration with an international consultants' group of known specialists in this field.

The need for this new evaluation arose, because two reference data which were believed to be known with high accuracy in 1969, have meanwhile changed.

The one value is the spontaneous fission-neutron yield of californium-252, $\bar{\nu}_t$ (Cf-252), relative to which the fission-neutron yields of uranium and plutonium are usually measured. The value recommended in 1969 was

$$\bar{\nu}_t \text{ (Cf-252)} = 3.765 \pm 0.012.$$

Based on some new measurements one believes now that a value of

$$\bar{\nu}_t \text{ (Cf-252)} \approx 3.736 \pm 0.008$$

is correct. The difference is only 1%, but three times the estimated error. Consequently, the $\bar{\nu}_t$ values of the uranium and plutonium isotopes, which are basic for reactor calculations, will have to be reduced by a similar amount.

About at the same time, it was found by new measurement, that the half-life of U-234, which was assumed in 1969 as

$$T_{1/2} \text{ (U-234)} = 248\,800 \pm 1600 \text{ years},$$

appears now as

$$T_{1/2} \text{ (U-234)} \cong 244\,600 \pm 200 \text{ years}.$$

The sample-assay in most U-235 fission cross-section measurements depends directly on the U-234 half-life. Consequently, the 0.0253 eV fission cross-section of U-235, which was recommended in 1969 as

$$\sigma_f^o \text{ (U-235)} = 580.2 \pm 1.8 \text{ barns,}$$

must now be assumed as

$$\sigma_f^o \text{ (U-235)} \cong 587 \pm 2. \text{ barns.}$$

Again, the difference of a bit more than one percent, is about three times the error, which was estimated in 1969 according to the best knowledge at that time.

A similar increase can be expected in σ_f^o (Pu-239), depending on the results of new measurements of the Pu-239 half-life, being done in the USA and at Geel. For U-233 a new precision measurement of σ_f^o being planned at Geel is quite important, since there exists only a single such measurement with little precision. Rather incidentally, but fortunately, the important product $\bar{\nu}_t \sigma_f^o$ which determines the neutron balance in a thermal reactor, remained unaffected by these changes. But most other data such as absorption cross-section, capture cross-section, the neutron-yield per absorption (η), will be affected, also for U-233 and Pu-241, since the data for these nuclides are often determined relative to U-235 and Pu-239. A best set of data will be obtained by a rather complex least-squares analysis of all existing experimental data.

Special care require the experimental data measured in a thermal Maxwellian spectrum. A cross-section $\hat{\sigma}$ for a 20°C Maxwellian, is related to the 0.0253 cross-section σ^o by the Westcott g-factor

$$g\ (20^oC) = \frac{\hat{\sigma}\ (20^oC)}{\sigma^o}$$

g is also defined as the Maxwellian average over the cross-section curve $\sigma(E)$ from zero to about 0.1 eV

$$g(T) \sim \int \sigma(E)\ \sqrt{E}\ \text{Maxw}\ (T)\ dE$$

where Maxw (T) is the Maxwellian distribution of the neutron flux with a temperature T. In this integral, the insufficient knowledge of the cross-section curve-shapes $\sigma(E)$ below 0.025 eV, is an essential source of uncertainty.

Whereas monoenergetic data and $\bar{\nu}_t$ data are quite consistent, existing Maxwellian experimental data are partially discrepant. It will require further studies of the sources of these discrepancies (perhaps distortions of the thermal neutron spectra?), until a new recommended set of 0.0253 eV and 20°C Maxwellian cross-sections and fission-neutron yields can be issued. This is envisaged for spring 1975.

F.4.2. Review of neutron cross sections used in reactor neutron dosimetry

The second part of the "Status of Neutron Cross Section Data for Reactor Radiation Measurements", consisting of a review of eleven (primarily threshold) neutron reactions used in reactor neutron dosimetry is near to completion and will be published as INDC(NDS)-47/L, Part II.

In comparison to the first part of this review, which relied primarily on evaluated data, the second part takes into account all available experimental and evaluated energy dependent cross section data as well as thermal fission spectrum averaged data, published up to July 1974.

This two-part review of reactor neutron dosimetry cross sections, performed by NDS, together with the comprehensive "Compilation of threshold Reaction Neutron Cross Sections" (EANDC 95 'U'), published by CCDN in cooperation with BCMN Geel, constitutes an up-to-date account of the state of the art of nuclear data in the field of reactor neutron dosimetry.

APPENDIX A

Current List of Liaison Officers to the INDC

June 1974

Argentina	Ricabarra, G.
Austria	Eder, O.J.
Bangla Desh	Islam, M.
Belgium	Nève de Mevergnies, M.
Bolivia	Paz Lore, 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.
Greece	Dritsa, S.
Hungary	Kluge, G.
Iran	Rouhaninejad, H.
Iraq	Said, K.I.
Israel	Ben David, G.
Jamaica	Chen, A.A.
Kenya	Gacii, P.
Korea	Kim, J.D.
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	Nimwanadon, Th
Turkey	Enginoi, T.
Uruguay	Lalanne, A.
Viet Nam	Vo Xuan Bang
Yugoslavia	Slaus, I.
Zaire	Pollak, H.

APPENDIX B

Sample page from computerized facilities list

MAR. 74 3EZLIEN CYCLO

LOCATION OF FACILITY
==========

INSTITUTO DE ENGENHARIA NUCLEAR, RIO DE JANEIRO, BRAZIL

FACILITY TYPE
==========

VARIABLE ENERGY CYCLOTRON

COMMERCIAL OR COMMON DESIGNATION
==========

CYCLOTRON CORPORATION CV-28

DESCRIPTION AND COMMENTS
==========

THE HOUSING FOR THE ACCELERATOR IS ALREADY UNDER CONSTRUCTION AND WILL BE A 1500 SQUARE-METER BUILDING WITH PHYSICS AND CHEMISTRY LABORATORIES, WITH A 400 SQUARE-METER EXPERIMENTAL AREA. EXTERNAL BEAM IS RATED AT 50 MICROAMPS.(MAY 1973)

TYPE, ENERGY AND INTENSITY OF ACCELERATED PARTICLES
==========

PROTONS - 2 TO 24 MEV
DEUTERONS - 3 TO 14 MEV
HELIUM-3 IONS - 5 TO 38 MEV
HELIUM-4 IONS - 6 TO 28 MEV
HEAVY IONS (ENERGY UNSPECIFIED)

USES AND APPLICATIONS OF THE FACILITY
==========

PRODUCTION OF NEUTRON DEFICIENT RADIONUCLIDES FOR MEDICAL USES WILL BE A PRACTICAL APPLICATION OF THE CYCLOTRON. RESEARCH ON NUCLEAR SPECTROSCOPY, NEUTRON PHYSICS, ACTIVATION ANALYSIS, RADIATION DAMAGE, AND NUCLEAR REACTIONS WILL BE PERFORMED.(MAY 1973)

SOURCE OF INFORMATION
==========

INDC(SEC)-35/L, CONSOLIDATED PROGRESS REPORT FOR 1973 ON NUCLEAR DATA ACTIVITIES IN THE NDS SERVICE AREA.(AUGUST 1973)

DATE OF LATEST INFORMATION
==========

MAY 1973

APPENDIX C

IAEA Consultants Meeting on Nuclear Data for Reactor Neutron Dosimetry

Vienna, 10 - 12 September 1973

Agenda

MONDAY, 10 September

I.	Opening of Meeting	Dunford
	A. Agency welcome	Dunford
	B. Need for internationally recommended cross sections for neutron dosimetry reactions	Farinelli
II.	Fluence Determination by Activation Methods	Zijp
	A. Critique of method(s) including accuracy, selection of reactions, limitations, etc.	Zijp
III.	Neutron Spectrum Determination by Activation Methods	McElroy
	A. Critique of method(s) including accuracy, selection of reactions, limitations, etc.	McElroy
	B. Critical comparison of spectrum unfolding codes	Dierckx
	C. Role of Standard Spectra in Differential Flux Determination	Dierckx
	D. Special problems at low energies $\leq$ 1 MeV	Najzer
	E. Determination of activity induced in monitors irradiated by neutrons	Czock

- continued

TUESDAY, 11 September

IV.	Nuclear Data Assessment	Liskien
	A. Important nuclear reactions and nuclear quantities required	Zijp
	B. Status of knowledge of important nuclear data	Vlasov
	C. Integral Measurements and Benchmarks	Fabry
	D. Needed data measurements	Liskien

WEDNESDAY, 12 September

V.	Selection of Standards and Reactions for which Internationally Accepted Values Are Desired	Farinelli
	A. Thermal and intermediate energies	Zijp
	B. Fast energies	McElroy
VI.	Recommendations to IAEA for Future Activities	Vlasov

APPENDIX D

IAEA Panel

on

Fission Product Nuclear Data

Bologna, 26-30 November 1973

Scientific Secretaries: M. Lammer) Nuclear Data Section
J.J. Schmidt) Div. of Research & Laboratories, IAEA

PROGRAMME

MONDAY, 26 NOVEMBER

Morning — Opening and Organization of the Panel

Review 1 a	M. Lammer IAEA	Introductory talk
Review 1 b	S. Valente CCDN Saclay	List of compilations, evaluations and computer codes of FPND (no oral presentation)

SESSION I: FPND user needs in application fields

Review 3	J.G. Tyror AEE Winfrith	Importance of FPND in the physics design of power reactor cores
Discussion		
Review 4	C. Devillers CEN, Saclay	Importance of FPND for engineering design and operation of reactors
Report	M.Ya. Kulakovsky FEI, Obninsk	USSR survey on topic of review 4
Discussion		

	Review 5	W.J. Maeck Allied Chem. Corp. Idaho Falls	FPND requirements for determination of nuclear fuel burnup
	Discussion		
	Report	R.E. Schenter Hanford Engg. Development Lab.	Report on CSEWG Task Force on "Nuclear Data for Fission Product Decay Heat and Burnup Calculation"
	Discussion		
Afternoon	Review 6	C. Weitkamp KFK	Importance of FPND for safeguards techniques
	Discussion		
	Review 7	E. Merz KFA Juelich	Importance of FPND for fuel handling
	Discussion		
	Review 2	A.K. Ganguli BARC, Bombay	FPND and environmental aspects of the nuclear fuel cycle
	Discussion		

TUESDAY, 27 NOVEMBER

Morning

SESSION I: (continued)

Review 8	W.K.G. Kuehn E.G. Niemann Inst. f. Strahlenbotanik, Hannover	Importance of FPND in life sciences, agriculture and industrial technologies
Review 9	E.L. Alpen Battelle Northwest	Use of FPND in life sciences
Discussion		

General discussion on the international cooperation in the exchange and dissemination of FPND information.

SESSION II: Status of fission product yield data, compilations and evaluations

	Review 15	M. Lott CEN, Cadarache	Residual power due to fission products
	Discussion		
	Review 16	A.R. de L. Musgrove J.L. Cook, G.D. Trimble AAEC Lucas Heights	Prediction of unmeasured fission product yields
	Discussion		
Afternoon	Review 11a	W.H. Walker AECL, Chalk River	Status of fission product yield data for thermal reactors
	Discussion		
	Review 11b	J.G. Cuninghame AERE, Harwell	Review of fission product yield data for fast neutron fission
	Report	W.J. Maeck	New measurements of fast fission yields
	Discussion	Formation of subgroups and selection of chairmen, secretaries and members:	
	Subgroup 1:	Cumulative yields	
	Subgroup 2:	Independent yields	
	Subgroup 3:	Neutron cross-sections	
	Subgroup 4:	Decay data	
	Subgroup 5:	Delayed neutron data	
	Subgroup 6:	International cooperation in the exchange and dissemination of FPND information.	

WEDNESDAY, 28 NOVEMBER

Morning

SESSION II continued

	Discussion	on user needs versus data status: fission product yields

Afternoon

SESSION III: Status of fission product decay data and delayed neutron data

Review 12	G. Rudstam Studsvik	Status of decay data of fission products
Discussion		
Review 13	S. Amiel Soreq Nucl. Res. Centre	Status of delayed neutron data
Report	B.P. Maksyutenko FEI, Obninsk	USSR activities in the field of delayed neutron data
Discussion		
Discussion	on user needs versus data status: delayed neutron data	

THURSDAY, 29 NOVEMBER

Morning

SESSION III continued

Discussion	on user needs versus data status: decay data	

SESSION IV: Status of neutron reaction cross-sections of fission products

	Review 10	P. Ribon CEN, Saclay	Status of neutron reaction cross-sections of fission product nuclides
	Discussion		
Afternoon	Review 14	M. Bustraan Petten	Integral determination of neutron absorption of fission products
	Discussion		
	Discussion	on data requirements versus data status: neutron reaction cross-sections of fission product nuclides	

FRIDAY, 30 NOVEMBER

Morning	Subgroups to draft conclusions and recommendations (meeting in parallel at the Centro di Calcolo)
Afternoon	Plenary discussion on draft conclusions and recommendations; Summary of the Panel

APPENDIX E

FOURTH INTERNATIONAL CODATA CONFERENCE

Tsakhcadzor Olympic Village, near Yerevan
Armenian, S. S. R., U. S. S. R.

24-27 June, 1974

CONFERENCE PROGRAMME

MONDAY, 24 JUNE, MORNING SESSION

I. A. OPENING CEREMONIAL SESSION
Co-chairmen: V.V. SYCHEV *(USSR)*
E. F. WESTRUM, JR. (USA)

1) *V.A. AMBARTSUMIAN (USSR)*

2) V.V. SYCHEV *(USSR)*

3) *B. VODAR (France)*

I. B. DATA CENTRES IN VARIOUS FIELDS
Co-chairmen: *A. WYSOCKI (UNESCO)*
R. N. JONES (Canada)

1) *D. LIDE (USA)* "The NSRDS Experience"

Coffee Break

2) *J.-E. DUBOIS (France)* "Ordering and Labeling Structural Data: Applications to Retrieval and Design"

3) *L. N. USATCHEV (USSR)* "Experience and International Cooperation of Nuclear Data Centre at Obninsk"

4) *M. KOTANI (Japan)* "Network of Data Centres for Dissemination of Data"

Short Communications

a) *O. KENNARD (UK)* "Problems of a Specialized Data Evaluation Centre"

b) *Y. L. DELCROIX & G. MATTHIEUSSENT (France)* "Presentation of Gaphyor: A Data Bank System for the Physics of Gases"

MONDAY, 24 JUNE, EVENING SESSION

II. COMPUTER USAGE IN DATA SYSTEM ORGANIZATION
Co-chairmen: *G. BLACK (UK)*
Yu. P. DROBYSHEV (USSR)

1) *O. KENNARD (UK)* "Computer Task Group Report on the Freiburg Man/Machine Symposium"

2) *T. SHIMANOUCHI (Japan)* "Role of the Regional Computer Centre in Reference Data Problems"

3) *V. E. HAMPEL (USA)* "Acquisition, Storage, Retrieval, Display, and Utilization of Computerized Data in the Lawrence Livermore Laboratory Data Bank of Physical and Chemical Properties"

4) *Yu. P. DROBYSHEV (USSR)* ""Long-distance Handling of the Chemical Data Bank in Novosibirsk"

5) *D. O. AVETISIAN & L. F. SARUKHANIAN (USSR)* "On the Rules of Numerical Data Publication in the Primary Literature"

6) *R. L. WIGINGTON (USA)* Introduction to and Presentation of Motion Pictures on Data Banks

Short Communication

a) *J. MALUSZYNSKI (Poland)* "Polish Work on Information Systems"

TUESDAY, 25 JUNE, MORNING SESSION

III. DATA CENTRES FOR INDUSTRIAL NEEDS
Co-chairmen: *Y. S. TOULOUKIAN (USA)*
H. JANCKE (GDR)

1) *Y. MASHIKO (Japan)* "Establishment of a Data Centre for the National Laboratories for Industry at the New Science City - Tsukuba"

2) *A. BYLICKI & S. MALANOWSKI (Poland)* "Thermodynamic Data for Engineering"

presented by König

3) *K. GÖTTLICH (GDR)* / "The Information System for Materials and Economic Use of Materials in the GDR"

Coffee Break

4) *J. MURDOCK (USA)* "User Aggregation for Data Center Development"

5) *R. W. MC INTYRE (UK)* "Management of Technical Data Within Industry"

6) *S. G. LABINOV (USSR)* "Data Centre for Thermodynamic Properties of Hydrocarbons and Oils"

TUESDAY, 25 JUNE, EVENING SESSION

IV. FORMULATION OF CODATA'S ROLE IN MEETING THE NEEDS OF THE BIOLOGICAL SCIENCES
Co-chairmen: *P. A. ALTMAN (USA); (alternate: V. P. CAPORALE)*
K. P. IVANOV (USSR), C. SCHAFER (GFR)

1) *G. L. RADFORD (UK)* "Characteristics of Data Collected by the Conservation Section of IBP, How They Will Meet Needs of Life Scientists, and How CODATA Can Assist in Fulfilling Needs"

2) *C. SCHÄFER (GFR)* "Perspectives of a National (German) Biological Information and Data Centre"

3) *V. B. D. SKERMAN (Australia)* "Activities of the World Federation for Culture Collections as Related to Needs of the Working Scientist for Non-numerical Data"

4) *K. P. IVANOV (USSR)* "Evaluation of Numerical Data in Biology and Biological Data Centres"

WEDNESDAY, 26 JUNE, MORNING SESSION

V. FORMULATION OF CODATA'S ROLE IN MEETING THE NEEDS OF THE GEOLOGICAL, GEOPHYSICAL, GEOGRAPHICAL, AND ASTRONOMICAL SCIENCES
Co-chairmen: *PROFESSOR MAGAKIAN (USSR)*
J. P. MELCHIOR (Belgium)

1) *J. P. MELCHIOR (Belgium)* "Characteristics of Data Required by Geophysicists"

2) *A. H. SHAPLEY (USA)* "World Data Centre A"

3) *V. P. GOLOVKOV (USSR)* "World Data Centre B"

4) *G. Y. CRAIG (UK)* "Characteristics of Data Required by Geologists; How Needs Are Being Met"

Coffee Break

5) *G. A. WILKINS (UK)* "Cooperation in the Provision of Astronomical Data"

6) *R. F. TOMLINSON (Canada)* "Spatial Data Characteristics and Handling Techniques"

Short Communications

a) *J. JUNG (France)* "The Role of Data Banks in Astronomy: Experience with the Stellar Data Centre in Strasbourg"

b) *R.A. SARKISSIAN & V. S. KROTOVA (USSR)* "Appreciation of Reliability of Astronomical Data Processing by Computer"

c) *P. M. HERUNY (USSR)* "Standardization of Sky Radiosources for Guarantee of Unity of Radiotechnical Measurements"

d) *A. T. ASLANYAN (USSR)* "On Numerical Data of Earth's Physical Parameters"

General discussion of short communications

WEDNESDAY, 26 JUNE (INFORMAL, PARALLEL, DISCUSSION) SESSION

A. Discussion of National and Union Delegates' Reports and other current or future CODATA activities. [An opportunity to compare notes and get further details on interesting developments with Delegates.]

B. Discussion of Task Group Reports

1) Fundamental Constants
2) Chemical Kinetics
3) Accessibility and Dissemination of Data
4) Key Values
5) Transport Properties
6) Computer Use
7) Training Scientists in Data Handling, Ascribing Precision, and Evaluation, etc.
8) Global Referral Centers
9) CODATA publication endeavors, Compendium, etc. [A chance for input and feedback concerning core CODATA activities both continuing and initiatory]

C. Panels on Data Presentation and Data Tagging

1) Presentation of Data (Panel Discussion)*
2) Data Tagging (Joint Working Group with ICSU-AB)

D. Discussion of Certain Problems of Methodology

1) Reliability of the Theoretical Representation of Data
2) Relation of Data to Measuring Systems
3) Utilization of Standards in Generation of Data

E. Other problems (if necessary)

Discussion on World Data Centers & CODATA

* [A panel to advise the Task Group on Data Presentation on the adequacy of its present recommendations in geo- and bio-areas, and means for its supplementation. On the data tagging issue -- an interchange with an informal panel of working group members and potential users.]

WEDNESDAY, JUNE 26, EVENING SESSION

VI. PROGRESS IN HANDLING SPECTROSCOPIC DATA
Co-chairmen: *D. R. LIDE (USA)*
C. N. R. RAO (India)

1) *V. A. KOPTUG (USSR)* "Molecular Spectral Data Centre of Novosibirsk"

2) *R. N. JONES (Canada)* "Recent Developments in the Display, Evaluation, and Storage of Molecular Spectral Data"

3) *R. F. BARROW (UK)* "Spectra and Spectroscopic Properties of Diatomic Molecules"

4) *W. C. MARTIN (USA)* "Some Recent and Ongoing Compilations of Atomic Spectral Data"

Short Communications

a) *M. A. EL'YASHEVICH & L. A. GRIBOV (USSR)* "Standardization and Accumulation of Data Used in Interpretation of Molecular Spectra"

b) *A. JOHANNIN-GILLES (France)* "Measurement Methods of Transition Probabilities in Faculté des Sciences of Brest"

THURSDAY, 27 JUNE, MORNING SESSION

VII. PROGRESS IN HANDLING THERMODYNAMIC DATA
Co-chairmen: *V. V. GURVICH (USSR)*
I. ANSARA (France)

1) *V. P. GLUSHKO (USSR)* "Academy of Science Series of Reference Books on Thermodynamic Properties of Substances"

2) *S. SUNNER (Sweden)* "Key Values for Thermodynamics: A Project Serving Science and Industry"

3) *S. ANGUS (UK)* "The IUPAC Thermodynamic Tables Project"

Coffee Break

4) *Y. S. TOULOUKIAN (USA)* "Thermophysical Data Project"

Short Communications

a) *E. E. SHPILRAIN & K. A. JAKIMOVICH (USSR)* "Automatic Search System in IHT Thermophysical Centre"

b) *J. B. PEDLEY (UK)* "Computer Analysis of Thermochemical Data"

c) *I. ANSARA (France)* "The Compilation and Critical Analysis of Thermodynamic Data for Ternary Alloy Systems"

d) *I. SOSNOWSKA (Poland)* "Data for Solid State Physics Obtained by Neutron Scattering"

e) *V. V. SYTCHEV (USSR)* "Soviet Commission on Thermodynamic Data"

General discussion of short communications

CLOSING REMARKS -- *L. V. GURVICH (USSR)*, Programme Chairman

APPENDIX F

SECOND INTERNATIONAL SYMPOSIUM ON

NEUTRON CAPTURE GAMMA RAY SPECTROSCOPY

AND RELATED TOPICS

September 2–6 1974, Petten, the Netherlands

Symposium secretariat:
Dr. K. Abrahams
Reactor Centrum Nederland
PETTEN (NH)
the Netherlands

March, 1974.

PRELIMINARY PROGRAMME

Monday, September 2, 1974

09.00-10.00	Coffee and registration.
10.00-10.30	Opening session.
10.30-11.00	P.M. Endt (Utrecht) Neutrons and gamma-ray strength.
11.00-12.00	A.M. Lane (Harwell) Direct capture. Correlations and statistical properties.
12.00-13.00	S.F. Mughabghab (Brookhaven) Review of correlation data.
13.00-14.30	Lunch and discussions.
14.30-15.30	C. Mahaux (Liège) Shell-model approach to the theory of low-energy neutron capture.
15.30-16.00	Tea.
16.00-17.00	V.G. Soloviev (Dubna) Simple configurations in the capture state.
17.00-18.30	Contributed papers on the theory of the neutron capture mechanism.
18.30-20.30	Cocktail buffet, to which all participants are invited by RCN.

Tuesday, September 3, 1974

09.00-10.00	G.A. Bartholomew (Chalk River) Photon strength functions.
10.00-11.00	J.B. Garg (Albany) Proton resonance capture studies.
11.00-12.00	Coffee.
12.00-13.00	R.E. Chrien (Brookhaven) Gamma rays from discrete and average resonance capture.
13.00-14.30	Lunch and discussions.
14.30-16.00	Contributed papers on discrete resonance capture. Chairman-reviewer: R.E. Chrien.
16.00-16.30	Tea.
16.30-18.00	Contributed papers on average resonance capture. a) Experiments with filtered beams. Reporter: R.C. Greenwood (Idaho Falls). b) Experiments with pulsed beams. Reporter: J.R. Bird (Lucas Heights).
20.00-22.00	Social programme.

Wednesday, September 4, 1974

09.00-10.00	Yu.P. Popov (Dubna) The (n,γα) reaction in neutron resonances.
10.00-11.00	I. Bergqvist (Lund) Fast neutron capture.
11.00-12.00	Coffee.
12.00-13.00	Contributed papers on fast neutron capture. Chairman-reviewer: I. Bergqvist.
13.00-14.00	Lunch.
14.00-21.00	Excursion (to Amsterdam).

Thursday, September 5, 1974

09.00-10.00	H.E. Jackson (Argonne) Threshold photoneutron spectra.
10.00-11.00	Contributed papers on nuclear photo-excitation. Reporter: R. Moreh (Negev).
11.00-12.00	Coffee.
12.00-13.00	K. Abrahams (Petten) Spin assignments with the (n,γ) reaction.
13.00-14.30	Lunch and discussions.
14.30-15.30	H. Postma (Groningen) Experiments with oriented nuclei and low energy neutrons.
15.30-16.00	Tea.
16.00-17.15	Contributed papers: a) Spin assignments with thermal neutron capture. Chairman-reviewer: K. Abrahams. b) Inelastic neutron scattering.
18.30-23.00	Banquet.

Friday, September 6, 1974

09.00-10.00	Contributed papers: a) Experimental developments. Reporter: P. Van Assche (Mol) b) Applications. Reporter: C.D. Bowman (NBS, Washington)
10.00-11.00	O.W.B. Schult (Julich) Thermal neutron capture.
11.00-12.00	Coffee.
12.00-13.00	Contributed papers on properties of nuclei with A > 208. Reporter: H. Weigman (Geel).
13.00-14.30	Lunch and discussions.
14.30-16.00	Contributed papers on decay scheme studies with thermal neutrons. Chairman-reviewer: O.W.B. Schult.
16.00-16.30	Tea.
16.30-17.30	Summary of the symposium.
17.30-18.00	Closing of the symposium.

IAEA Advisory Group Meeting on Transactinium Isotopes Nuclear Data (= TND), fall 1975

Objectives and Organization

1. Objectives

A specialist meeting on nuclear data for transactinium isotopes is being planned by the IAEA's Nuclear Data Section. The meeting will be held in the fall of 1975, the exact date and place being yet undetermined.

The following are the main objectives of the meeting:

- The panel should bring together users and producers of TND.
- Users of TND should specify their nuclear data requirements and their priorities in detail as a prerequisite of the panel's discussions, conclusions and recommendations.
- The status of knowledge of microscopic TND should be reviewed including a critical comparison of existing evaluations and compilations.
- The panel should identify and discuss measurements, compilations and evaluations required to satisfy the needs of transactinide nuclear data users and sensitivity studies required to better specify user needs. It should aim at specific recommendations and measures for coordination of future work.

2. Organization

In order to meet these objectives, the format of the meeting is envisaged to be the same as that for the Panel on Fission Product Nuclear Data held recently in Bologna.

a) The body of the meeting should be formed by comprehensive review papers covering the full scope of use, status and testing of TND and forming the basis for the discussions of the panel. The suggested titles for these papers are given below together with instructions regarding objectives and contents of each paper. After informal contacts with specialists and with the appropriate national authorities through INDC members and INDC Liaison Officers, a suitable expert will be selected by IAEA/NDS as reviewer for each review paper. The task of the reviewer will be to write a comprehensive and coherent review of his subject incorporating his own contributions and those he will receive from relevant specialists in other institutions and countries.

b) Our experience with the organization of the Bologna Panel suggests that

- reviewers of user needs should send lists of TND required to reviewers of the data status;

- reviewers of data status should include in their papers tables with achieved accuracies for data appearing in the lists received from the "needs" reviewers;

- reviewers of data requirements (data status) should prepare short lists of required (achieved) accuracies, extracted from their papers for distribution to participants before the panel;

- user requirements supported by sensitivity studies would be extremely valuable, particularly in complex cases or where high accuracy is required;

- reviewers should include recommendations in their papers for further discussion by the participants.

c) In order to achieve maximum efficiency and results, the meeting in addition to the presentation of the review papers mentioned under a), should devote its time to discussions on as many open questions as possible rather than spend much time on additionally submitted original contributions. These discussions will require the participation of carefully selected users, compilers and evaluators, and measurers of TND.

d) The meeting should discuss the following categories of data:

- thermal and resonance neutron cross sections
- fast neutron cross sections
- half life and decay data.

Prompt gamma ray production cross sections should not be discussed.

e) In general, needs for nuclear data for all transactinides would be a proper subject for discussion in the review papers and at the meeting. However, in the area of reactor core physics, the needs for neutron cross section data for the main fertile and fissile isotopes (Th-232, U-233, U-235, U-238, Pu-239) has been so extensively reviewed in the past that the subject should be excluded from consideration. Likewise the status of the available neutron cross section data for these nuclides is well covered elsewhere and should not be discussed at this meeting.

3. Review Papers and their Contents

I. REVIEWS OF USER NEEDS IN APPLICATION FIELDS

These review papers should in general contain the following information:

a. detailed specification and technical background for required data and accuracies, and their relative importance in the different fields of application, preferably supported by sensitivity studies;

b. assessment of present data status from the user's view;

c. technical and economic justification and priorities for improving the present data status;

d. desirability of the data being available in computer media (magnetic tape, etc.) in addition to the normal form of published tables, handbooks, etc.

Paper No. 1. Importance of TND in the Physics Design of Reactor Cores

Including: long term behaviour, kinetics and dynamics, production of bulk quantities of transactinides

Paper No. 2. Importance of TND for Engineering Design and Operation of Reactors

Including: contamination of reactor components, heat release after reactor shutdown and its determination, accidents and environmental considerations

Paper No. 3. Importance of TND for Fuel Handling

Including: fuel storage and transport, reprocessing, refabrication, recovery of bulk quantities of transactinides, and waste disposal, including environmental aspects.

Paper No. 4. Importance of TND for Fuel Analysis

Including: inventory calculations, destructive and non-destructive fuel analysis, particularly for safeguards.

Paper No. 5. Importance of TND in Non-Reactor Applications

Including: isotopic heat sources and medicine.

II. REVIEW OF THE STATUS OF TND

These review papers should in general contain the following information:

a. discussion of measurement techniques including sources of error and accuracies;

b. discussion of error analysis methods;

c. critical discussion of evaluation techniques;

d. short description of contents, coverage of important data and quality of available evaluations;

e. survey of existing TND not yet included in evaluations, and of experiments and evaluations in progress;

f. status and uncertainties of TND and discussion of important discrepancies (with emphasis on those individual data required by users);

g. Recommendation of presently available evaluations appropriate for particular user groups;

h. recommendations on further experimental and compilation/evaluation work needed.

Paper No. 6. Status of Neutron Cross Sections in the Thermal and Resonance Regions

Including:

a) capture and fission cross sections

b) resonance parameters and statistics

c) thermal average cross sections and infinite dilute resonance integrals and comparison with microscopic data

d) any other important cross sections

Paper No. 7. Status of Neutron Cross Sections in the Fast Region

Including:

a) capture and fission cross sections

b) elastic and inelastic scattering cross sections

c) neutron and charged particle production cross sections

d) spectrum averaged cross sections and comparison with microscopic data

e) review of systematics for calculating unmeasured and/or unmeasurable data and their reliability

Paper No. 8. Status of Decay Data of the Transactinides

Including: half-life data for alpha and other particle emission, gamma-ray and conversion electron energies and intensities, β-ray mean energies and intensities, branching ratios, total $(\beta + \gamma)$ energy yields.

APPENDIX H

Responses to the survey on the usefulness of CINDA

Australia (Gemmell)

"Our main users are Allen, Boldeman, Cook and Musgrove. They, plus other casual users, agree on the essential usefulness of CINDA. We also realize its limitations as regards completeness and up-to-dateness. However, we live in a very incomplete, practical world".

Bangladesh (Islam)

"CINDA is of immense help to all physicists connected to neutron data measurement, compilation and evaluation. We are of the opinion that this is a major effort of the Nuclear Data Section of the IAEA and this service should be continued at all cost. Similar compilation in the field of charged particle nuclear physics would be a valuable addition for the benefit of the nuclear physicists".

Bulgaria (Nadjakov)

"The usefulness of CINDA is gratefully acknowledged by our scientists, and especially by those using its data for neutron cross-section analysis; no comments".

Czechoslovakia (Rocek)

"CINDA is available in information centres (libraries) and according to the information from the librarians it is used extensively as it offers a review information on the work accomplished."

Germany (Federal Republic) (Cierjacks)

"Until today none of the CINDA recipient has formally replied to my inquiry. Personal discussions with several users, however, showed that the usefulness of CINDA has been stressed with no exception. Several of the users have only some minor problems with abbreviations which are used and not being explained in some supplements, separately. My impression is, that there are no particular problems in our country".

Hungary (Kluge)

"Though the usefulness of CINDA is in many cases obvious, it has to be noted that the reports used and referred to are often difficult to acquire".

India (Divatia)

"I have no specific comments on CINDA entry problems. As regards CINDA usefulness it is not possible to give any statistics, however, the general feeling is that CINDA is useful to those who are seeking information of the type they are not usually conversant with. Further, for any application oriented work, CINDA is found to be useful".

Japan (Nishimura)

"The existing of CINDA is well recognized among the Japanese scientists concerned, and we are effectively using of it. At present we are satisfied with the allotment of CINDA distribution. At this opportunity, we would like to express our sincere thanks for your excellent services in maintenance and improvement of CINDA system."

South Africa (Republic of) (Reitmann)

"As producers of neutron data my own group - and the same applies to others in this country- finds CINDA extremely useful. It is always our first source of information whenever we plan an experiment or start analysis of data. I also know that scientists who require data for reactor calculations, shielding, neutron activation or comparison with theory, make extensive use of CINDA. We are also quite happy with the services provided by the NDS even though we are small customers. The only complaint, for which NDS can probably not be held responsible, concerns confusion caused by the differences in format and representation between data sets from different files and origin, specifically when the format is not clearly defined".

Sweden (Conde)

"Concerning CINDA, it is in general thought as a very useful reference document and no special entry problems have been put forward".

U.K. (Rose)

"Following the discussions on CINDA at the last INDC meeting the United Kingdom Nuclear Data Committee considered the publication at its last meeting. The members felt that it is an invaluable publication which is frequently used by measurers, evaluators and users of neutron nuclear data. It is a "desk top tool" that tends to be consulted frequently and would lose much of its value if its contents were only available on request from the data centres.

If the sales of CINDA are going down this probably reflects the reduction in the number of people working in the field of neutron nuclear data. However, sales are not a true reflection of its value to the Scientific Community. The need for CINDA probably goes up as the number of scientists decreases because the amount of information is still expanding and the remaining active scientists have individually to expand their knowledge to cover a wider range of data. As far as the U.K is concerned we would expect casual sales to be small because the copies distributed through CCDN (and paid for through the CCDN budget) are allocated so that all known users have access to a copy.

CINDA is perhaps a model desk-top nuclear data index. Entries are made by experts from many countries - at no cost to CCDN and perhaps the data centres - - and this shows that the experts and their funding agencies consider the publication to be valuable. It has an extremely good coverage of neutron cross-section data, particularly for those published in the last few years. The coverage, however, is probably not so good in the more peripheral areas, e.g. fission yields, thermal scattering dat a and any defciencies may reflect the interests of the current CINDA readers. Improvements could be made by positively encouraging users of CINDA to send in comments when entries are faulty or are missing altogether. At one time there were postcards in the book which could be returned in these circumstances.

In conclusion I would like to say that we in the U.K. feel that CINDA is one of the most important publications produced by the data centres".

APPENDIX I

Tenth Meeting of the Four Neutron Data Centers

Paris, 6 - 10 May 1974

1. Agenda

Monday, 6 May

1. Organization and Announcements, election of chairman, discussion and adoption of agenda, review of actions from past meetings

2. Presentation and discussion of progress-reports from the four Neutron Data Centers

Tuesday, 7 May

3.a Center heads: Recommendations from recent IAEA meetings on non-neutron nuclear data, and future plans

3.b Technical staff: EXFOR

4. Reports from sessions 3.a and 3.b

5. CINDA

Wednesday, 8 May

Visit to NDCC, Saclay, including sessions on

6. EXFOR, more-dimensional tables

7. Special report by M. Vlasov on benchmark experiments and the March 1974 meeting of the Euratom Working Group for Reactor Dosimetry

Thursday, 9 May

8. CINDA, continued

9.a Center heads: Continuation of 3.a

9.b Technical staff: EXFOR, continued

10. WRENDA

Friday, 10 May

11. Remaining parts from previous sessions

12. Formulation and adoption of actions and recommendations

13. Other business, conclusions

2. List of participants

US National Neutron Cross-Section Center (NNCSC):

Mr. S. Pearlstein, data centre head
Mrs. V. May

OECD/NEA Neutron Data Compilation Centre (NDCC):

Mr. F. Frühner, data centre head
Mr. L. Lesca, (chairman)
Mr. A. Schofield, (local secretary)
Mr. H. Potters
Mr. N. Tubbs
Mr. K. Rickeby
Mr. K. Okamoto

IAEA Nuclear Data Section (NDS):

Mr. J.J. Schmidt, data centre head
Mr. H.D. Lemmel, (Scientific Secretary)
Mr. M. Vlasov

USSR Centr po Jadernym Dannym (USSR Nuclear Data Center, CJD):

Mr. V. Manokhin, data centre head