International Atomic Energy Agency

INDC(NDS)-31/L

INDC INTERNATIONAL NUCLEAR DATA COMMITTEE

REPORT OF THE NUCLEAR DATA SECTION

TO THE INTERNATIONAL NUCLEAR DATA COMMITTEE,

JUNE 1970 TO MAY 1971.

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

INDC(NDS)-31/L

REPORT OF THE NUCLEAR DATA SECTION

TO THE INTERNATIONAL NUCLEAR DATA COMMITTEE.

JUNE 1970 TO MAY 1971.

TABLE OF CONTENTS

* * *

A P P E N D I C E S

* * *

INDC(SEC) Documents published since last INDC Meeting

(SEC)-9/L	Official Minutes of the Second INDC Meeting
(SEC)-10/G	Methods of Work
(SEC)-11/G	Chairman's Report on the INDC for 1968 and 1969, G.H. Kinchin
(SEC)-12/U	INDC Correspondents for the Exchange of Nuclear Data Information, November 1970
(SEC)-13/U	List of Documents Received by the INDC Secretariat, November 1970
(SEC)-14/L + Addendum	List of IAEA Meetings for 1971, January 1971; Addendum: June 1971
(SEC)-15/L	Compendium of Committee Regulations of the INDC (DRAFT PROPOSAL), April 1971
(SEC)-16/U	List of Documents Received by the INDC Secretariat, May 1971
(SEC)-17/U	INDC Correspondents for the Exchange of Nuclear Data Information, May 1971

INDC(NDS) Documents published since last INDC Meeting

(NDS)-24/G	Preliminary CINDA index to the papers of the Helsinki Nuclear Data Conference, June 1970
(NDS)-25/L	Conclusions and Recommendations of the two IAEA Experts Meetings on α (Pu-239) and $\bar{\nu}$ data, Studsvik/Sweden
(NDS)-26/L	Report on the Helsinki Conference Questionnaire
(NDS)-27/G	Report on the Second International CODATA Conference and Fifth Annual CODATA Meeting, St. Andrews/Scotland, September 1970
(NDS)-28/G	Report on the Sixth Four-Centre Meeting
(NDS)-29/U	Aspects of Critical Evaluation of Nuclear Data Information, J.J. Schmidt
(NDS)-30	Report of a Consultants Meeting on Non-Neutron Nuclear Data, November 1970
(NDS)-31/L	Report of the Nuclear Data Section to the INDC, June 1970 to May 1971

INDC(NDS) Documents to be published (work in progress)

(NDS)-32/L	Evaluation of the α-value for Pu-239 in the energy region from 0.1 keV to 1 MeV; V.A. Konshin/M.G. Sowerby

- continued

* * *

A. Introduction

The following progress report of the Nuclear Data Section (NDS) of the IAEA to the International Nuclear Data Committee (INDC) covers the period from June 1970 to May 1971. The staff of NDS presently consists of 10 physicists, 3 programmers, 2 data processing clerks and 3 secretaries. During the last year, Bak (Korea) and Koster (South Africa) have returned to their home countries after a two year-stay with the IAEA; they will be replaced in the course of the next months.

During this period the exchange of experimental data within the EXFOR system between the four world neutron data centres has been established on a routine basis. The Four-Centre Meetings in Saclay in October 1970 and in Vienna in December 1970 reviewed the EXFOR system and problems of its full implementation in extensive detail. Systematic efforts were made by NDS to convert entries in the DASTAR system to EXFOR. NDS responded to an increased number of requests for evaluated neutron data and is actively pursuing the full implementation of evaluated neutron data exchange.

In April 1971 NDS published "CINDA 71", which is the first CINDA issue published by IAEA. A particular feature of this edition is the use of space and cost-saving computer-controlled phototypesetting, which also provides a better legibility.

A number of reviews of data topics of current importance have been performed. These cover, e.g., Pu-239 α and fission, U-238 capture, $\bar{\nu}$ for all heavy isotopes, fission threshold reactions and prompt fission neutron spectra. In response to recommendations by INDC, NDS is currently preparing a Specialist Meeting on the Status of Prompt Fission Neutron Spectra and a Panel on Neutron Nuclear Data Evaluation to be held in the middle of this year.

Upon the recommendation of a Consultants Meeting on Non-Neutron Nuclear Data convened in December 1970 an International Working Group on Nuclear Structure and Reaction Data has been created. The first meeting of this group will take place in January 1972.

As a result of extensive discussions within IAEA and within the INDC Subcommittee on Nuclear Data for Safeguards the procedures for both national and international screening of nuclear data requests for safeguards have been established. A survey of nuclear data needs for fusion reactor development is being prepared on the basis of responses to an enquiry sent to IAEA Member States in October 1970.

In April this year the Administrative and Budgetary Committee of the Board recommended to the IAEA Board of Governors that a sum of US$15,000 be appropriated in the NDS budget for 1972 for the targets and samples project of NDS.

B. INDC Secretariat

B.1. Liaison Officers

In the last letter from the INDC Secretariat to INDC Liaison Officers, it was announced that the NDS has stopped publication of the NDS Information Letter; instead, the more comprehensive NDS report to the INDC will receive a wider (L) distribution as of this year. This change was also supported by the recommendation of the INDC, at its last meeting, to distribute the approved official minutes of INDC meetings to Liaison Officers, giving them a more detailed account of the meetings' proceedings.

In the past, progress reports from Liaison Officers have been submitted to the INDC separately, each having its own cover and designation. In general each of these individual reports consisted of a few pages. On the basis of suggestions received from our service area, and with an aim to induce a closer relationship between Member States, we are considering this year to consolidate all reports submitted from those countries in the NDS service area (which includes all IAEA Member States with the exception of the US, Canada, OECD Member States [Western Europe and Japan], and the USSR) not directly represented on INDC, into one single report and giving this combined progress report a wider distribution. In view of the random arrival of the individual progress reports at NDS prior to the INDC meeting, and the deadlines to be met at that time, it is proposed to produce such a consolidated report after the INDC meeting, at a time when all contributions will have reached the INDC Secretariat.

The current list of 36 individuals presently serving as Liaison Officers to the INDC, is given in Appendix A.

B.2. Compendium of Committee Regulations

As recommended by the Committee at its Third Meeting (see Actions 6 and 7), the INDC Secretariat has drafted a Compendium of Committee Regulations, which has been distributed to the INDC Members as a draft proposal, under the designation INDC(SEC)-15/L. The approved version of this document will be distributed to INDC members and Liaison Officers after the meeting. (Note that Liaison Officers form only part of the INDC "L" distribution [~ 40 recipients], and that this document will have to have a restricted "L" distribution, unless it is distributed to the full "L" distribution (~200 recipients). The Compendium, which contains five sections now, can be updated, changed and amplified as need arises.

B.3. List of Correspondents

The current list of "INDC Correspondents for the Exchange of Nuclear Data Information" has been distributed as INDC(SEC)-17/U in May 1971. The next list will be distributed in November 1971.

B.4. List of Documents

The current list of INDC documents has been distributed as INDC(SEC)-16/U in May 1971. This current list contains reference to all INDC documents received between January 1968 and May 1971, and therefore supersedes the two interim lists INDC(SEC)-8/U and INDC(SEC)-13/U, published in June and November of 1970 respectively. The next interim list, to be published in November 1971, will contain reference to INDC reports received or announced between May and November 1971. Reference to earlier INDSWC and "interim INDC" reports received between 1962 and 1967, are listed in report INDC/199 (dated November 1967).

B.5. Translation of documents

Volumes 8 and 9 of the "Collected Abstracts" of Nuclear Research in the USSR, were received by the INDC Secretariat in 1970. These two documents were translated into English by the IAEA and were subsequently issued in December 1970 as INDC(CCP)-8/U and INDC(CCP)-9/U respectively.

The Sixth Volume of the USSR Nuclear Data Centre Bulletin was received and distributed as INDC(CCP)-12/G in April 1971. The table of content of this document was translated into English by NDS and distributed under the same document number with an L distribution in April 1971.

The description of the "Format of the Recommended Nuclear Data Library for Reactor Calculations", by V.E. Kolessov and M.N. Nikolaev (FEI, Obninsk), submitted at the Dutch-Belgian-Soviet Seminar held at Melekess in February 1970, has been translated by NDS and distributed as INDC(CCP)-13/L, in December 1970. This report is representative of the current development of a Soviet format for evaluated data by Dr. Nikolaev's group at Obninsk.

The report by L.P. Abagyan et al. on the "Cross-Sections for Radiative Neutron Capture by Uranium-238 Nuclei", presented at the July 1970 Helsinki Conference on Nuclear Data for Reactors (paper CN-26/80), was translated by the IAEA and distributed as INDC(CCP)-11/U in March 1971.

The following six reports have recently been received from Obninsk with the translations made partly at Obninsk and partly by IAEA:

- Sh.S. Nickolayshvili et al., "Methods and Programmes for fast reactor calculation",

- V.V. Filippov, M.N. Nikolaev, "Measurement of the structure of total neutron cross sections",

- A.A. Vankov et al., "Temperature dependence of the cross section structure of U-238 in the region of unresolved resonances",

- M.N. Nikolaev et al., "The method of the average group cross section calculation in the region of unresolved resonances",

- N.E. Gorbatov et al., "Investigation of the reactivity worth of different materials in the fast assembly BFS-16",

- L.V. Antonova et al., "Re-evaluation of U-235 fission and U-238 capture cross sections based on analysis of critical parameters of ZPR-III critical assemblies".

These reports, which have not been published otherwise, give a good overview on fast reactor theory and evaluated nuclear data checking work performed recently in the Obninsk Nuclear Reactor Division. It can be anticipated that they will be of considerable interest to reactor physics and evaluation groups also in other countries. Therefore NDS plans to issue all six papers in one report with the title "Recent fast reactor physics work in the USSR, with emphasis on self-shielded resonance cross sections and adjustment of evaluated nuclear data to the results of fast critical assemblies" and to publish this as report INDC(CCP)-14/U during summer this year.

C. Meetings

C.1. Past Meetings

C.1.a. IAEA Panel on Pulsed Neutron Research, Vienna, 17-21 August 1970

The Panel was organized by the Physics Section and discussed the following programme:

- Instrumentation for pulsed neutron research
- Applications in nuclear physics and condensed matter research
- Pulsed neutron research in heterogeneous systems
- Pulsed neutron time-of-flight measurements and pulsed neutron measurements in fast reactors
- Theoretical and mathematical studies
- Application of pulsed neutron research in technology.

Pulsed reactors were found to be limited to the larger countries. Extensive discussions centered around the relative merits of pulsed accelerators like Van de Graaffs and boosted linacs and pulsed reactors and of the various techniques of producing pulsed neutrons. The strongest potential of pulsed machines was seen in solid state physics applications.

C.1.b. Second International CODATA Conference, St. Andrews, Scotland, 7-11 September 1970; Fifth Annual Meeting of CODATA, St. Andrews, 12 September 1970.

For a summary of the more important highlights of both meetings including a description of the organization, membership, liaisons, achievements and future activities of CODATA we refer to the report INDC(NDS)-27/G distributed in September 1970 to INDC Members.

Here we would like to draw the attention only to what in our opinion is so far the most useful achievement of CODATA, i.e. the first edition of an "International Compendium of Numerical Data Projects" issued by the Springer Verlag in 1969. Although still far from complete this compendium gives a first world-wide survey of data centres and projects and their publications in various scientific disciplines including nuclear data. A new, more complete edition, which is in preparation, will contain in particular an improved coverage of USSR data compilations and of data handbooks. The nuclear data parts of the first edition also need improvement and updating. Recognizing the importance of this compendium, NDS will be prepared to give every needed relevant help to its updating.

C.1.c. IAEA Panel on Contained Peaceful Nuclear Explosions for Industrial Purposes, Vienna, 18-22 January 1971

The Panel was organized by the Division of Nuclear Power and Reactors. It gave a review of national interests in peaceful nuclear explosions and discussed in particular:

- industrial applications such as natural gas and oil reservoir stimulation, creation of natural gas storage in underground cavities and the extinguishing of uncontrolled gas wells,

- safety aspects of peaceful nuclear explosions such as mechanical, seismic and radioactive effects.

The discussions were confined to purely technical problems and did not touch upon nuclear physics experiments at all. The proceedings of the panel will be published around October this year. The next IAEA Panel on the subject is tentatively scheduled for about mid 1972.

C.1.d. IAEA Consultants Meeting on Capture Gamma Spectroscopy, Vienna, 22-23 February 1971

The meeting was convened by the Physics Section. Dr. P.M. Endt from Rijksuniversiteit Utrecht, Netherlands, Dr. D. Kiss from the Central Research Institute for Physics in Budapest, Hungary, and Dr. F. Cvelbar from the Institut Jozef Stefan in Ljubljana, Yugoslavia, served as consultants. First, Endt gave a review on activities of the major groups engaged in charged particle radiative capture work. In a similar way Kiss reviewed work on radiative capture of thermal and resonance neutrons, with particular emphasis on capture gamma spectra and nuclear level scheme investigations, Cvelbar reviewed work on radiative capture of fast neutrons, with particular emphasis on the reaction mechanism. The rest of the meeting was devoted to detailed preparatory discussions for the Conference on the Study of Nuclear Structure with Neutrons planned by the Hungarian Academy of Sciences for mid 1972 (see C.2.j.).

C.1.e. Third Conference on Neutron Cross Sections and Technology, Knoxville, USA, 15 - 17 March 1971

This Conference was attended by V. Konshin from NDS. He presented the paper "IAEA activities in reviews of nuclear data - Pu-239 fission and U-238 capture in the fast neutron energy region" by T.A. Byer and V.Konshin. In the opinion of the NDS participant the Conference demonstrated particularly the large and well balanced programme of the US in the field of measurements, evaluation and integral testing of neutron data.

C.1.f. Regional Study Group Meeting on Low Energy Accelerator utilization, Rio de Janeiro, 15-19 March 1971

This meeting was held by the Agency's Physics Section and sponsored jointly by IAEA, the Latin American Centre for Physics (CLAF, directed by Dr. Roberto Bastos da Costa, with headquarters in Rio de Janeiro, established under the aegis of UNESCO), the National Nuclear Energy Commission of Brazil and the Brazilian Centre for Physics Research.

It is worthwhile to mention that this meeting was a direct consequence of Mr. Byer's mid 1969 Advisory Service Mission to Argentina, Brazil, Chile and Mexico. By his visit to CLAF he initiated closer cooperation and information exchange between CLAF and IAEA and stimulated the idea of holding the present meeting.

Through the Agency's Scientific Secretary of the Meeting, Dr. S.I. Whetstone, Head of the Physics Section,, Mr. Byer submitted a paper entitled "The Role of Neutron Data Measurements in the Utilization of Low Energy Accelerators" (INDC(NDS)-39/L). In this paper Dr. Byer emphasized, on the basis of RENDA and fusion reactor requests for neutron data measurements, particularly those classes of measurements which should be readily within the capabilities of existing accelerator groups in Latin America and gave an outline of possible assistance from the IAEA, particularly as regards the acquisition of accelerator targets and foils for nuclear data measurements. This latter programme of the Agency aroused particular interest among the participants.

Some two dozens particle accelerators are expected to be in use in Latin America in 1971. The main aim of the meeting was to convene scientific heads and active researchers of the leading Latin American accelerator groups, together with a few selected experts from the US and Europe, to discuss within a broad scope the best utilization of these machines as well as to explore the possibilities for regional cooperation and coordination of effort. The meeting was attended by about 30 participants from six Latin American countries (Argentina, Brazil, Chile, Colombia, Mexico and Peru).

From the presentation of present and planned accelerator facilities and their current research programmes it was clear that the experience and interest of the majority of the Latin American participants are focussed on basic nuclear physics, whereas the agenda topics and the selection of experts deliberately emphasized practical applications of accelerators. For illustration we quote from one of the experts, Dr. Beyster from the US, who concluded that "it is clear that particle accelerators of the kind available in Latin America now can provide much useful information for the development of new technologies like non-destructive quantitative analysis, reactor physics, and biomedical research. These accelerators can continue profitably to provide fundamental information of utility including neutron cross section data"

Appendix B contains:

- a list of the participants in the meeting
- a list of accelerators in Latin America expected to be in use during 1971
- recommendations for IAEA from the participants of the Study Group Meeting.

The more extensive report by the Scientific Secretary of the Study Group Meeting has been made available to INDC Members.

C.1.g. Meeting of the IAEA Working Group on Reactor Radiation Measurements, Vienna, 19-21 April 1971

The full report on the Working Group Meeting by its Scientific Secretary, Mr. A. Keddar from the IAEA Division of Nuclear Power and Reactors, has been distributed to INDC Members. Therefore we restrict ourselves here to nuclear data matters discussed during the meeting.

In response to the interest shown by the Working Group, NDS briefly reported on relevant activities and services of the four world neutron data centres. Quite some discussions of the Working Group were devoted to nuclear data needs for reactor radiation dosimetry and for investigations of irradiation effects.

In view of the still existing discrepancies and gaps in the experimental information, and in view of the difficulties caused in the intercomparison of different neutron spectra and fluence measurements by the use of different evaluated data sets and the non-existence of internationally accepted reference data sets, the Working Group recommended, as a first step to improve the situation, that NDS prepare a Status Report on Neutron Cross Section Data, commonly used in reactor dosimetry and radiation effects investigations, and that this report be distributed three months before the next meeting scheduled for the second half of 1972 to the Members of the Working Group as well as of its Subgroup I. (Subgroup I is concerned with fast neutron flux and spectra measurements and with thermal neutron flux measurements at high temperatures.)

NDS has accepted to write such a status report which will cover, for selected isotopes, the following neutron data and reaction types:

- (n,p), (n,α) and (n,2n) cross sections (mostly threshold reactions),
- (n,γ) and (n,f) cross sections,
- thermal capture cross sections,

- activation resonance integrals,

- half lives of radioactive product nuclei.

A detailed list of the individual isotopes and reactions concerned will soon be prepared by NDS and, before starting work on the status report, will be checked with the members of the Working Group, Mr. P. Mas from Grenoble (Chairman of Subgroup I) and Mr. W. Zijp from Petten. The full text of the recommendation of the Working Group is given in Appendix C .

C.1.h. Fourth Annual Meeting of the International Working Group on Fast Reactors (IWGFR), Vienna, 5-7 May 1971

The following two main subjects were discussed at the Fourth IWGFR Meeting. Half of the meeting was devoted to an extensive review of the status, main problems and future prospects of national fast breeder projects in France, Federal Republic of Germany, Italy, Japan, UK, USA and USSR. All of these countries give strongest emphasis to the sodium breeder, whereas gas or steam cooling receive less support. The discussion centered mainly around exchange of experience with fuel element and cladding failure as obtained with the existing fast reactors or in specimen irradiations. Differences in safety philosophy became apparent: some countries like France or the USSR, on the basis of experience with RAPSODIE and BR-60, would tolerate some fuel failures during reactor operation, others like the US expressed a firmer attitude. All, however, felt that not enough statistics had been accumulated so far. After the discovery of swelling of fuel element cladding under neutron irradiation a couple of years ago great efforts have been made of finding those steels which would show no swelling; it appears as if both the USA and the USSR had some recent success in this respect.

The second half of the meeting was devoted to a discussion of topics and place for the IAEA Symposium on Fast Reactors planned for 1973 in Karlsruhe, to a consideration of Non-Agency fast reactor conferences in 1971-73 and of IAEA specialists meetings on various technical fast reactor subjects in 1971-72.

The proceedings of the Fourth IWGFR Meeting will be made available to INDC Members in due course. Schmidt reported briefly on those review activities of the Nuclear Data Section concerned with important neutron data for fast breeders. IWGFR is very interested to receive all those INDC documents and other information relevant to fast breeder nuclear data interests. It was agreed to put IWGFR Members on the corresponding distributions.

C.1.i. Fourth IAEA Conference on Plasma Physics and Controlled Nuclear Fusion Research, Madison, Wisconsin, USA, 17-23 June 1971

This Conference, organized by the Physics Section, aroused great interest and was attended by about 600 people. Previous conferences in this series were held at Salzburg in 1961, at Culham/UK in 1965, and at Novosibirsk in 1968. As at these previous conferences, those aspects of plasma physics which are directly related to fusion research were dealt with at this conference. In view of the progress made towards the goal of fusion power, and the desirability of maintaining a close association between theory, experiment and technology, the range of topics for the present conference was extended to include discussion of fusion reactors. The sessions dealt in particular with the following topics:

- Internal ring devices,
- Pinches; stabilization methods,
- Tokamaks,
- Plasma focus; laser and electron beam produced plasmas,
- Turbulence,
- Open confinement systems,
- Closed confinement systems,
- Theta pinches; shock waves,
- Reactor systems,
- High frequency heating.

The International Fusion Research Council was convened during the course of the meeting in Madison.

As this had to be written in advance of the Conference, any interesting information which might arise from the Conference and from the Council regarding nuclear data for fusion will be directly reported at the INDC Meeting.

C.2. Future Meetings

C.2.a. Sixth Annual Meeting of CODATA, National Academy of Sciences, Washington, D.C., 19-20 July 1971; CODATA Symposium and Panel Discussions on Principles and Practices of Data Evaluation, National Bureau of Standards, Gaythersburg, Maryland, 21 July 1971

As in former years IAEA was invited to nominate a Liaison Representative to attend the above CODATA Meetings. Budgetary limitations will not allow this year to send an IAEA representative, but through the good relationships to CODATA officials we will certainly be informed of any relevant facts which might arise from these meetings and thus be able in turn to inform INDC Members.

The subject of the symposium will be"The use of proper techniques of handling both random and systematic errors,"which is certainly also very relevant to neutron data. Four speakers will be invited to deal with the application of statistical methods in error evaluation, as well as with the evaluation of errors resulting from either using the wrong statistical tool, or from choosing the wrong physical model in the interpretation of the experimental data, and finally with the evaluation of errors resulting from fallacies in experimentation.

The panel discussion will deal with problems connected with the presentation of data in the primary literature, such as the economical aspects of presenting large amounts of data, and of presenting research results in sufficient experimental detail to allow a proper evaluation of the data. The panel will be composed of representatives from data evaluation centres and editors of primary journals.

Upon request of the CODATA Central Office in Frankfurt information on the following subjects has been sent by NDS to CODATA for inclusion in the next edition of the CODATA Newsletter:

- CINDA 71
- IAEA activity in the field of nuclear structure and reaction data
- IAEA neutron nuclear data meetings in the second half-year of 1971.

C.2.b. IAEA Consultants Meeting on the Status of Prompt Fission Neutron Spectra, Vienna, 25-27 August 1971

Within the overall aspect of neutron data evaluation, which will be the topic of a Panel meeting at the IAEA this summer (see paragraph C.2.c.), the detailed knowledge of the fission neutron spectrum is of considerable importance. As recently as a few years ago, it was generally accepted that the neutron energy spectra from prompt fission of important

isotopes were adequately well known. Since that time, however, results from integral experiments have indicated a ten percent higher fission temperature and the presence of energetic fine structure in the spectrum. These results have stimulated renewed interest in this problem, so that at the present time several groups have either completed or are in the process of completing new measurements.

In view of these factors it was felt that a meeting of experts involved in these measurements would be opportune at this time. The meeting has been scheduled to take place in the week preceding the evaluation panel, 25-27 August 1971, at the Agency's Headquarters in Vienna. It is hoped that this group will be successful in defining the sources of discrepancies and make recommendations for future work to solve this and other remaining questions concerning the fission spectra. The provisionally proposed agenda items are:

1. Review of differential measurements and presentations of recent results on the spectra of U-235 and Pu-239 for incident thermal neutrons and Cf-252.

2. Discussion of possible angular anisotropy in the spectra.

3. Discussion of fine structure in the spectra.

4. Review of recent fission spectrum determinations using e.g. threshold reactions.

5. Effect of fission spectrum changes on reactor calculations.

6. Spectra of other isotopes.

7. Dependence of fission spectra upon neutron incident energy.

8. Theoretical interpretation of measured fission spectra.

9. Other points of interest.

10. Conclusions and recommendations.

The first point on the Agenda should serve to establish the present knowledge and information available on the fission spectra of U-235, Pu-239 and Cf-252. As a contribution to this meeting the NDS is currently reviewing the available fission spectrum data, and will publish its results in INDC(NDS)-35/L (see paragraph E.4.d.).

C.2.c. IAEA Panel on Neutron Nuclear Data Evaluation, Vienna, 30 August - 3 September 1971

This Panel is convened by the Nuclear Data Section upon the recommendation of INDC; the scientific secretary will be Dr. T.A. Byer from NDS.

The main objectives of this Panel will be to review the methods, quality and present status of neutron nuclear data evaluation, as well as to examine the basic requirements and problems associated with establishing and exchanging computer-based evaluated neutron data liraries. A total of 15 countries and two international organizations (EURATOM and ENEA) with major nuclear data programmes have been invited to send participants to this panel, the official invitations were sent out in April this year.

On 5 and 6 April 1971 a preparatory meeting for the evaluation panel was convened in Vienna, in which Prof. Benzi from Bologna, Italy, Miss Hinkelmann from Karlsruhe, Germany, Dr. Ribon from Saclay, France, and Mr. Story from Winfrith, UK, participated. This meeting agreed on a detailed provisional agenda and organization of the panel; the provisional agenda is given in Appendix D.

The panel will proceed as follows. It will start on the first day with a plenary session dealing with reviews of evaluation activities and needs in IAEA Member States (for the planned NDS review of this topic see paragraph D.1.). Points 2-5 of the agenda regard technical topics which will be discussed on the two following days in five subgroup meetings in parallel. The topics of the individual subgroups will correspond to agenda items 2, 3, 4, 5I and 5II. Names of chairmen for the five subgroups were provisionally suggested, their actual availability is still not sure. Each subgroup will prepare a report on its discussions, conclusions and recommendations and submit it for further considerations and amendments of the plenary meeting on its fourth day. On the last day a concluding session is planned on international cooperation in evaluation, etc. (agenda item 6).

The preparatory meeting also discussed the question of the chairmanship for the panel proper and came to the conclusion that the best solution will be not to have one chairman for the whole of the panel, but to have a separate chairman on each of the three plenary, introductory, discussion of subgroup reports and concluding, sessions.

C.2.d. Fourth Geneva Conference, 6-16 September 1971

One member of NDS will probably be able to take part in the first half of the Conference, which will be particularly devoted to topics such as:

- Projected role of nuclear energy in meeting future energy needs,
- Survey of world energy demand and resources up to the year 2000,
- Peaceful applications of nuclear explosions,
- Status and prospects of controlled thermonuclear reactors,
- Developments in breeder and advanced converter reactors,

- Optimum integration of nuclear power plants in electrical networks,
- Safeguards systems analysis and objectives,
- Safeguards techniques and instrumentation.

The second half will be devoted mainly to discussions of

- Organizational aspects of international cooperation,
- Reactor fuel cycles and radiation effects,
- Advanced and special applications of nuclear energy and research,
- Aspects of nuclear technology of particular interest for developing countries,
- Nuclear applications in food and agriculture, life sciences, applied research and industry.

NDS will take part in the Geneva Conference Exhibition by exhibiting a panel and a little brochure illustrating its activities and cooperation with the other three neutron data centres.

C.2.e. International Conference on Chemical Nuclear Data, Canterbury, UK, 20-22 September 1971

Due to budgetary limitations NDS will not be able to take part in this interesting Conference. It was therefore agreed with the British INDC Member, Dr. Rae, that the observer, which Dr. Rae would like to send to this Conference, write a report covering the highlights of the Conference, and send this also to NDS. The Conference will cover the following topics:

- Fission product yields in thermal and fast neutron spectra,
- Application of fission yield data in burn-up determinations and fuel behaviour investigations in water- and gas-cooled thermal systems and fast reactors,
- Cross sections of light and heavy elements, including capture-to-fission ratios,
- Determination of nuclear decay rates and decay schemes (α, γ and neutron spectra, half life determinations, delayed neutron emission)
- Applications in reactor systems (burst fuel detection, circuit contamination, reactor fuel management, fuel processing, fission product data and inventory calculations).

The Conference will be sponsored by the British Nuclear Energy Society.

C.2.f. Intergovernmental Conference for the Establishment of a World Science Information System (UNISIST), Paris, UNESCO-House, 4-9 October 1971

In January 1967 a joint UNESCO/ICSU Central Committee was created to carry out a feasibility study on the establishment of a world science information system (UNISIST). The conclusions and recommendations resulting from this study were published in a Study Report on UNISIST, and also in an abridged version, a Synopsis, of this report. The UNISIST Feasibility Study will be the basic working document at the above mentioned Intergovernmental Conference which will be convened by UNESCO. Before this Conference UNESCO will hold a Meeting of an Ad-Hoc Working Group of Organizations in the UN family on UNISIST, at its Headquarters in Paris, 1-2 June 1971, to which also IAEA participation was invited.

The Synopsis of the UNISIST Feasibility Study has recently been distributed to INDC Members together with a small report (INDC(NDS)-38/G) containing comments from NDS on UNISIST. These comments have also been presented at the Ad-hoc Working Group Meeting beginning June. In brief, they are mainly concerned with the fact that the UNISIST study and recommendations in their present stage restrict themselves to documentation systems instead of attacking the much more ample and difficult but also much more relevant problem of "total information" (= documentation + data + additional relevant scientific information) collection, evaluation and transfer, as it is performed in specialized data centres in many scientific disciplines. If a giant undertaking such as UNISIST wants to have any success and practical impact at all, it is recommended that it is only concerned with documentation problems or, that it bases its considerations on the ample experience collected in many specialized data centres, last not least also in the neutron data field, taking also into account former extensive research in the subject as, e.g., reported in the well-known "Weinberg report".

C.2.g. International Symposium on Research Materials for Nuclear Measurements, Gatlinburg, USA, 5-8 October 1971

This Conference is sponsored by the US Atomic Energy Commission and by Oak Ridge National Laboratory. It will present all those material aspects connected with samples, targets and other research materials generally neglected in nuclear data conferences. It can be considered as a (highly needed) follow-up meeting of the EANDC conference in Oxford in 1963 on a similar subject. NDS felt that many of its customers might be interested in this subject and therefore distributed to them in January this year the announcement and preliminary programme of the Conference. The following topics will be dealt with:

- preparation of high purity isotopes and alloys,
- coating technology in preparations of targets, "standard sources", and other nuclear research materials,

- self-supported film and foil preparations
- preparation and handling of single crystal metals, alloys, compounds, and films of separated isotopes,
- problems in metrology and assay,
- electron microscopy and X-ray diffraction techniques.

The Conference will close with a panel discussion on problems of the user versus the fabricator.

C.2.h. IAEA Symposium on Neutron Inelastic Scattering, Grenoble, 6-10 March 1972

This Symposium will be convened by the Agency's Physics Section. So far no programme of this symposium is available.

C.2.i. International Summer School on Nuclear Data for Reactors, Romania, Summer 1972

NDS was informed by its new Romanian Liaison Officer, Mr. Rapeanu, that the Romanian Atomic Energy Commission plans to hold an International Summer School on Nuclear Data for Reactors at Brasov (formerly Kronstadt) in summer 1972. Any details regarding arrangements and topics of this summer school have still to be awaited.

C.2.j. International Conference on the Study of Nuclear Structure with Neutrons, Balatonfüred, Hungary, 5-12 September 1972

This Conference will be jointly sponsored by the Department of Mathematical and Physical Sciences of the Hungarian Academy of Sciences and by IUPAP; co-sponsoring by IAEA has still to be decided. The conference is considered as a follow-up meeting of the EANDC Conference in Antwerp in 1965 which had the same title as this Conference.

C.2.k. Third IAEA Symposium on the Physics and Chemistry of Fission, 1973 (probably)

As the two preceding symposia with the same title, also this symposium will be convened by the Agency's Physics Section. It is felt that a third symposium is needed as the subject is still an active one bearing on many facets of the Agency's programme and meriting further exchange of information. No further details are so far known on this symposium.

C.3. NDS Meetings in 1972 and 1973

C.3.a. Second IAEA Panel on Neutron Standards, 1972

Place and date for this Panel have still to be fixed.

The recent EANDC Symposium on Neutron Standards and Flux Normalization at Argonne, 21-23 October 1970, gave a comprehensive review of the current status of the more important well-known neutron standards and of the current techniques for neutron flux and absolute neutron cross section measurements. Accordingly, the accuracy requirements, e.g., for neutron cross section measurement programmes for fast reactors are almost met only for the $H^1(n,n)$ and $C^{12}(n,n)$ and for the low energy part of the $He^3(n,p)$, $Li^6(n,\alpha)$ and $B^{10}(n,\alpha)$ reactions. Further work needs to be devoted and is currently underway on the latter three reactions in the higher keV and MeV ranges where they are of special importance for neutron spectrum measurements in reactors and where still large inconsistencies exist in the available experiments. The same is true for the fast $Au^{197}(n,\gamma)$ and $U^{235}(n,f)$ cross sections, for which the existing discrepancies of the order of $\pm$ 5 to $\pm$ 15% have still not been resolved. Also the 2% discrepancy between the liquid scintillator and Mn-bath results for Cf-252 is still not clarified; work is still going on regarding the investigation of the so-called "French effect" (i.e. the dependence of the γ-ray detection efficiency on the fission neutron multiplicity) in liquid scintillator measurements.

In view of the extensive work on standards still going on, particularly also on the above mentioned data and discrepancies, the holding of a Second IAEA Panel on Neutron Standards appears to be very desirable. Regarding the actual topics to be discussed at this Panel it is recommended to put particular emphasis on the open problems and still existing discrepancies as partly outlined above. Because of its basic importance as standard for many capture and fission cross section measurements the establishment of a reliable U-235 fission cross section in the KeV and MeV ranges should be given particular priority; in fact, the capture and fission problems of (non-U-235) heavy isotopes will not be resolved unless a reliable U-235σ_f-standard is available. NDS will be prepared to submit a comprehensive review of the available information on σ_f (U-235) measurements to the Panel as a basis for its discussions on this subject.

It should be noted that originally another Panel on the Status of Heavy Isotope Cross Sections was foreseen. Because of budgetary restrictions only one panel can be held in 1972 . This is not very disturbing, as a few important subjects like σ_f(U-235) are common to both panels. Furthermore, as e.g. the σ_f(U-235) problem, because of the many ratio measurements, cannot be considered separately from such cross sections as σ_γ(U-238), σ_f(Pu-239) (aside from other standards like σ_γ(Au)) it seems to be logical to incorporate those subjects like a review of the status of σ_γ(U-238), σ_f(Pu-239) and other relevant data, which actually would belong to the Heavy Isotopes Panel, into the agenda of the Standards Panel. NDS is just preparing a review report on the available measurements on

σ_f(Pu-239), σ_γ(U-238), σ_γ(Au) and their ratios to σ_f(U-235) (see paragraph E.4.b.). This again, together with a collection of more recent information available at that time, can serve as a basis for discussion at the Standards Panel. It is hoped that the conclusions of this review can be reported at the INDC Meeting.

C.3.b. First Meeting of the International Working Group on Nuclear Structure and Reaction Data, Vienna, 24-28 January 1972

This topic is dealt with in paragraph D.3. of this report.

C.3.c. Symposium on the Collection, Compilation, Indexing, Evaluation and Distribution of Nuclear (including Neutron) Data, 1973

This Symposium was recommended by INDC and found the approval of the Agency's Scientific Advisory Committee at its meeting in December last year. Because of budgetary reasons and in order to hold the Symposium close in time to the meeting of the International Working Group on Nuclear Structure and Reaction Data, which is supposed to meet in about annual intervals, a date early in 1973 seems to be favourable. So far no arrangements have been made for the symposium. Time, place, agenda topics, invited speakers, etc., will be discussed at the INDC Meeting and at the first meeting of the Working Group.

In addition to the Working Group's annual meetings, which obviously can only convene a restricted number of selected experts, the Symposium could fulfill the very important function of bringing together the various nuclear data groups from all over the world for an extensive exchange of experience, giving each of these groups the opportunity to describe its programmes, aims, services, and achievements to the other groups, and helping to bridge the (anyhow artificial) gap between neutron and non-neutron data groups.

C.3.d. Other possible meetings for 1972 and 1973

At the last INDC Meeting Taschek proposed two possible topics for meetings in 1973:

- High intensity neutron sources,

- Neutron capture γ-ray spectroscopy.

The latter meeting was suggested as a follow-up meeting of the Studsvik Symposium in 1969.

A further suggestion has been made by Benzi, who proposes a specialists meeting in 1972 or 1973. Regarding the first topic proposed by Taschek for 1973 INDC should discuss the desirability and probable size of such a meeting. The second topic would certainly be of symposium size.

In the discussion it should be borne in mind that it is highly improbable that NDS, from its own budget, could finance any panel or symposium in 1973 in addition to the Nuclear Data Symposium. On the other hand, as outlined in the preceding paragraph, a Nuclear Data Symposium appears to be very desirable and should not be postponed to a later date.

D. Coordinating Activities and Surveys

D.1. Survey of neutron data evaluation needs and activities in IAEA Member States

Following the suggestion made at the Preparatory Meeting for the IAEA Panel on Neutron Nuclear Data Evaluation held in Vienna, 5-6 April 1971, NDS is going to prepare a world-wide survey of neutron data evaluation needs and activities in IAEA Member States for submission to the above-mentioned Panel. For this purpose it has sent out a circular letter and questionnaire with detailed points of enquiry into the above subjects to pertinent individuals in more than 30 Member States. This circular letter plus enclosures are to be found in Appendix E.

D.2. Status of the World Request List for Neutron Data Measurements (RENDA)

At the last meeting of the INDC, June 1970, the NDS submitted a list of 650 requests for neutron data measurements compiled from the USSR and from Non-OECD countries. This list was contained in the draft report INDC(NDS)-20/G.

This document has not been updated since that time for the reason that the USSR wanted to have some time to make a careful review before updating the list of requests submitted earlier.

A more thorough review of the practical implementation of a world-wide RENDA prepared and published by NDS is being prepared for the meeting.

D.3. Non-Neutron Nuclear Data Activities

In response to a number of proposals on the topic of non-neutron nuclear data that have been received in the course of the last few years, the IAEA convened a group of consultants, from the USA, France, the Netherlands and Euratom (Geel), in Vienna, 23-25 November 1970. The task of these consultants was to review the status of nuclear structure and reaction data with regard to its compilation, evaluation and dissemination. The conclusions and recommendations of this Consultants Meeting are contained in the report INDC(NDS)-30, distributed March 1971.

In summary, the status reports presented at the meeting demonstrated a severe shortage of manpower, funding and coordination in the existing dispersed activities which has contributed to a delay of data coverage of the order of five years. The principal recommendation of this consultants group was for the IAEA to take the necessary initiative steps to form an "International Working Group on the Compilation, Evaluation and Dissemination of Nuclear Structure and Reaction Data". The suggested Terms of Reference for this Working Group are included in the Consultants Meeting report INDC(NDS)-30.

Subsequent to this recommendation, the IAEA approved the formation of this Working Group, and is planning to call its first meeting at the IAEA Headquarters, 24-28 January 1972. The provisional agenda for this meeting is given in Appendix F .

D.4. Nuclear Data Needs for Fusion Reactors

In view of the recent interest in the realization of controlled thermonuclear fusion and of the anticipated development of the fusion reactor technology, the INDC at its last meeting (Vienna, June 1970) recognized that nuclear data for fusion be included in the responsibilities of the INDC. In order to ascertain the needs for nuclear data for fusion reactor development, the Committee recommended that the NDS investigate this need by writing to the Members of the International Fusion Research Council. In compliance with this recommendation the NDS sent out a circular letter in October 1970 to the members of this Council. A copy of the letter and its distribution is given in Appendix G. Replies to this enquiry were received from most of the ten Member States which were approached, with the most significant contributions coming from the UK, the USA and the USSR. An analysis of the replies and the formulation of the data needs in the form of a request list is presently being written, and will be published as INDC(NDS)-37/L in the second half of this year.

D.5. Nuclear Data Needs for Safeguards Development

At the last INDC Meeting (June 1970), the Committee, after establishing a Sub-Committee on Nuclear Data for Safeguards Technical Development, examined the draft request list (INDC(NDS)-21/G and Addenda) and arrived at two important conclusions.

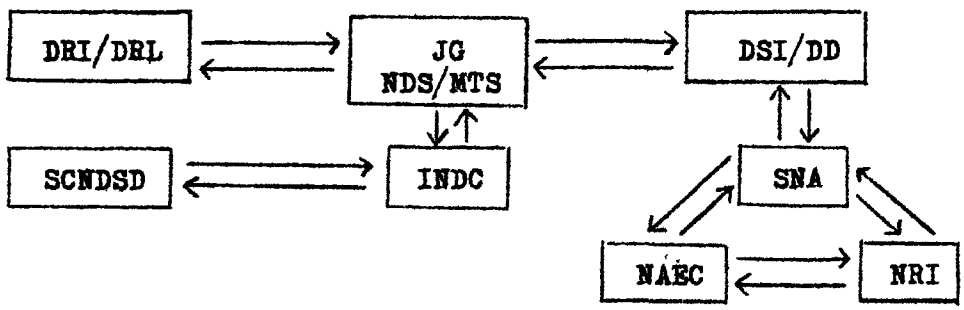
First, the Committee felt that before the Agency takes any further action regarding this matter, appropriate steps should be taken so that nuclear data requests for safeguards are screened by the relevant safeguards and nuclear data committees in each Member State, before such requests are forwarded to the Agency for inclusion in an international request list.

Second, the Committee recognized that the question of the establishment of criteria for priority assignments to each request was especially difficult and would require the close collaboration of the relevant safeguards experts.

As a result of these two considerations extensive discussions have been held during the past year between the staffs of the Division of Development (DD) (Department of Safeguards and Inspection) and the Nuclear Data Section. As a means of coordinating those activities of the Department of Safeguards and Inspection (DSI) and the Department of Research and Isotopes (DRI) which are related to nuclear data for safeguards development, the Agency has recently established a Joint Group consisting of members from the relevant Sections of these two Departments.

The members of this Joint Group are Drs J.J. Schmidt and T.A. Byer (Nuclear Data Section from the DRI) and Drs A. Waligura and S. Sanatani (Methods and Techniques Section from the DSI). Fig. I shows the relationships between the Joint Group, the Departments in question, the INDC and the relevant national organizations having an interest in the question of nuclear data for safeguards purposes.

Fig. I



DRI/DRL - Department of Research and Isotopes/Division of Research and Laboratories

DSI/DD - Department of Safeguards and Inspection/Division of Development

JG - Joint Group

NDS/MTS - Nuclear Data Section/Methods and Techniques Section

SCNDSD - Sub-Committee on Nuclear Data for Safeguards Development

INDC - International Nuclear Data Committee

NAEC - National Atomic Energy Commissions

NRI - National Research Institutes

SNA - Safeguards National Authorities

The salient points in this organizational chart are: first, that all official communications between the Agency and the Safeguards National Authorities (SNA) in Member States related to nuclear data for safeguards will be channelled through the Department of Safeguards and Inspection (DSI/DD). Second, the nuclear data needs and priorities expressed by the various safeguards development groups in Member States would be submitted through the SNA to the DSI/DD.

Third, the DSI/DD would assess those aspects of nuclear data which have a bearing on safeguards (e.g. reviewing the priority criteria to be assigned to nuclear data requests). Fourth, following this assessment, the Joint Group (JG) will prepare and submit to the INDC a screened list of nuclear data needed to further the technical development of safeguards.

This implies that the list of nuclear data which is submitted to the INDC by the JG would have been thoroughly screened from the safeguards standpoint. It is then up to the Committee to screen this list from the data standpoint prior to it being finally released as a Committee document. These procedures will clearly ensure the official nature of such a request list both from the standpoint of the Agency and the Member States.

During the latter part of this year the Agency will convene in Vienna a Research Coordination Meeting on Coordination of the Development of Instrumentation for Safeguards Purposes from 30 August - 3 September 1971; the special topic of this meeting will be "γ-Spectrometry Techniques and Instruments for Safeguards". In addition, a Research Contract (No. 995/TC) is presently being performed by Dr. J.R. Beyster of JRB Associates Inc. (USA) in which the relevant information will be collected on, and a critical review performed for, about 40 different assay techniques of interest to safeguards. It is expected that the results of this Research Contract will be available towards the end of 1971 and some of the

items which will be investigated under this contract are given in Appendix H . The results of the Research Coordination Meeting and of the Research Contract should provide additional information concerning the role of nuclear data in the development of safeguards techniques and instruments.

D.6. Targets and Samples

At the end of April 1971, the Administrative and Budgetary Committee of the Board recommended to the IAEA Board of Governors that a sum of US$ 15,000 be appropriated in the 1972 budget for the purpose of supplying targets and samples for nuclear data measurements in developing countries. Subsequently, the Nuclear Data Section sent out a circular letter (see Appendix I) to inform scientists mainly in developing countries of the procedures to follow in applying for a specific target or sample, and of the procedures to be followed by INDC in screening those requests.

In view of the late date of the above decision, it has not been possible to disseminate the circular letter early enough in order to receive a representative sample of the requests in time for the INDC meeting. A final version of INDC(NDS)-22, "Requests for Targets and Samples for Nuclear Data Measurements from Developing Countries", is projected for the autumn of 1971.

E. Data Centre Activities

E.1. NDS Area Service

The primary objective of NDS is the promotion of a world-wide dissemination of nuclear data information, and the coordination of individual nuclear data programmes with specific emphasis on neutron physics.

In this context the NDS provides data centre services to a defined part of the world, and together with three other regional data centres (NDCC, the ENEA Neutron Data Compilation Centre at Saclay; CJD, the USSR Nuclear Data Centre at Obninsk; and NNCSC, the National Neutron Cross Section Center at Brookhaven) cooperates in a systematic world-wide collection, compilation, analysis, dissemination and exchange of neutron data and related information.

In parallel with the development of the EXFOR neutron data inter-centre exchange system, which eventually will make all experimental neutron data available to each of the four regional data centres, NDS, since its inception in 1963, has maintained and promoted an active data centre activity. Generally, these activities can be classified as follows:

- Maintenance of data files
- Maintenance of data file index
- Up-to-date coverage of service area
- Promotion of data centre use
- Data centre operation and service activity

The following developments of these activities can be reported for the period June 1970 - May 1971.

E.1.a. Maintenance of Data Files

Until last year (1970), NDS has kept all experimental data in its data storage and retrieval system DASTAR. With the advent of "EXFOR" (an inter-centre neutron data Exchange Format, consisting of a computer-compatible set of agreed upon definitions and conventions, designed for the transmission of neutron data information) and its adoption by NDS as the basis for its internal data storage and retrieval system, all new data compiled at NDS are coded into the "EXFOR" format. Similarly, after the final details of the EXFOR system were agreed upon at the last Four Centre Meeting, NDS has started a systematic conversion of the data coded in the DASTAR system into the EXFOR system. Because of the free format of information in DASTAR it is not possible to transform these entries automatically into EXFOR. The DASTAR sets originating from the NDS area are, therefore, to be converted by hand. Priorities for conversion of these data sets have been assigned on the basis of isotopes, highest priority being given to those isotopes most needed for reactors and shielding. The tables below indicate the state of the conversion to date:

DASTAR data sets converted:

Priority	No. of DASTAR data sets	No. of EXFOR entries
1	238	77
2	4	4
Total:	242	81

56 of these 81 EXFOR entries have been sent to the other centres within the regular exchange of transmission tapes between centres (see paragraph E.3.a.), 25 are still in process or awaiting further information.

DASTAR data sets remaining for conversion:

Priority	No. of DASTAR data sets
1	106
2	125

Data stored in the files of NNCSC and CCDN which originated from laboratories in the NDS service-area are being converted into EXFOR by NDS; most of these data are anyway part of DASTAR.

E.1.b. Maintenance of Data file index. CINDU.

The index which contains all references to the data stored in all of the data files kept at NDS is called CINDU. This data index continues to fulfill a double function: primarily, the CINDU publication serves as an important communication medium between the NDS and the data users and producers in its service area, showing them the current content of the NDS files of experimental and evaluated neutron data; at the same time it is a necessary tool for the daily compilation work of NDS staff.

CINDU-10, scheduled to be published in summer 1971, will index the following data files:

(1) EXFOR: all data that have been exchanged under the EXFOR exchange agreement, including contributions from all 4 centres;

(2) DASTAR: the remaining parts of the DASTAR file as long as those have not yet been converted to EXFOR-format;

(3) KEDAK: the 1971 updated version of the Karlsruhe evaluated neutron data library

(4) UK NDL: essential parts of the Aldermaston-Winfrith library (the complete library has not yet been released to the NDS);

(5) the Bologna library of fast (n,γ) data of fission-product isotopes;

(6) the Australian evaluation of low energy (n,γ) data of fission product isotopes;

(7) the 1968 Obninsk evaluations of differential elastic and inelastic cross-sections (included in DASTAR);

(8) the Hungarian library of evaluated data used for flux measurements with fission-, resonance- and threshold-detectors;

(9) the recommended data resulting from NDS reviews.

E.1.c. Up-to-date coverage of service area.

One of the continuing responsibilities of the NDS is the systematic collection and compilation of experimental neutron data from its service area. This function, which it shares with the other three regional data centres (in the USA, Western Europe and the Soviet Union) should guarantee the availability of all experimental neutron data to users in all IAEA Member States.

In addition to the current coverage, for which NDS scans approximately 60 journals from its service area, a particular effort has been made to complete the back coverage of literature which has originated in the NDS service area.

E.1.d. Promotion of Data Centre use

Aside from a wide free dissemination of the CINDU catalogue, and of other reports issued by the Nuclear Data Section, which publicize the existence of this nuclear data centre at the IAEA, the NDS is presently preparing a pamphlet to publicize the services offered by this centre.

As part of the overall effort to improve the services of the data centre, personal contacts between NDS staff and scientists in the various laboratories are encouraged by providing as regularly as possible for one field trip every year to regions within its service area. A detailed account of the field trip undertaken to Eastern European Institutes by H.D. Lemmel (NDS), in November 1970, is given Appendix J.

E.1.e. Data Centre Operation and service functions

The service functions of the NDS data centre consist of exchanging and disseminating nuclear data information in response to specific requests. These functions are routinely recorded at the data centre in three Logs:

- a Request Log, designed to keep continuous account of all requests for nuclear data information which are sent to and from the NDS;
- an Experimental data distribution Log;
- an Evaluated data distribution Log.

The information recorded in the last two Logs includes: data set identification, number of data lines, destination and date of dissemination.

(1) Request Log Statistics

In the context of the Request Log, a request is defined as a written or oral communication between a member of the NDS centre and a correspondent, directed to or from the centre (either from within or outside the NDS service area), having the specific object of requesting nuclear data information. Nuclear data information comprises: numerical data, either experimental or evaluated, documents and CINDA retrievals. Each initiated request is assigned a unique Request Number and is classified according to origin and type.

The information given in Table I summarizes the request statistics since October 1965, and gives the number of requests which have been

either received at, or originated by NDS in the course of the last period June 1970 - May 1971. The request origin is grouped into three categories: a) Incoming requests, b) Follow-up requests (requests initiated by the NDS as a result of an incoming request), and c) NDS originated requests. Each of these three request categories are subdivided according to the four service areas: Area 1 for the NNCSC service area, Area 2 for the NDCC service area, Area 3 for the NDS service area, and Area 4 for the CJD service area. The information for each of these categories is broken down according to request type. Totals are given for each line and column.

(2) Data dissemination statistics

In the process of answering requests for data, NDS either sends out information which it has available at the centre, or requests the needed information from other centres which it then sends to the requestor. In this context, dissemination implies information sent by NDS from its own files. In addition, large quantity of data have "passed through" NDS, either in the form of computer listings or magnetic tapes, which were requested from the NNCSC (Brookhaven) or CCDN (Saclay) for a requestor in area 3 or 4. Although data transmissions of this type still occur, they will be less needed as the files of each centre are gradually filled with all of the available data. For EXFOR data transmissions, see section E.3.a.

The current statistics on the dissemination of experimental and evaluated data are given in Table II. This table summarizes the distribution of these data by service area, in terms of data sets and data lines, for the period October 1966 to May 1971 given under cumulative total, and for the period June 1970 - May 1971.

It is of interest to note (see Table II) that whilst, below average interest was expressed for experimental data during the last period (approximately 10% of the total data lines disseminated during the last one year period), a high degree of interest was expressed for evaluated data. More than half of the evaluated data lines ever sent out by NDS, were disseminated in the course of the last one year period - more than half of these, to Member States in the NDS service area. These evaluated data consisted primarily of the KEDAK and UK data files. The complete KEDAK file has been sent on request to four separate groups: to Yugoslavia (Matausek), India (Sengupta), Hungary (Vertes), and Korea (Chung).

TABLE I

SUMMARY OF NDS REQUEST STATISTICS AS OF MAY 1971

REQUESTS FOR ——	EXPERIMENTAL DATA		EVALUATED DATA		DOCUMENTS		CINDA RETRIEVALS		TOTALS	
REQUEST ORIGIN	Cumulative totals	70-71* period	Cumulative totals	70-71* period	Cumulative totals	70-71* period	Cumulative totals	70-71* period	Cumulative totals	70-71* period
Incoming from Area 1	22	2	1	0	14	3	0	0	37	5
" " " 2	31	2	0	0	29	12	1	1	61	15
" " " 3	50	11	19	7	35	17	14	6	118	41
" " " 4	34	6	12	7	8	1	7	0	61	14
Incoming: Subtotal	137	21	32	14	86	33	22	7	277	75
Follow-up to area 1	46	8	1	1	0	0	0	0	47	9
" " " 2	42	10	6	4	1	0	14	2	63	16
" " " 3	46	2	0	0	0	0	0	0	46	2
" " " 4	26	4	1	1	2	0	0	0	29	5
Follow-up: Subtotal	160	24	8	6	3	0	14	2	185	32
NDS origin: sent to Area 1	16	4	0	0	1	0	0	0	17	4
" " " " " 2	25	13	2	0	3	2	4	1	34	16
" " " " " 3	101	13	0	0	0	0	0	0	101	13
" " " " " 4	10	0	0	0	0	0	0	0	10	0
NDS origin: Subtotal	152	30	2	0	4	2	4	1	162	33
TOTALS:	449	75	42	20	93	35	40	10	624	140

* This column gives number of requests which have been either received at, or originated by NDS in the course of the last period: June 1970 - May 1971

TABLE II

Experimental Data Dissemination *

(as of May 3, 1971)

	Number of data sets		Number of data lines	
	Cumulative total	1970-1971 period	Cumulative total	1970-1971 period
To Area 1	531	0	34.921	0
" " 2	253	4	15.639	4
" " 3	579	252	117.681	13.489
" " 4	146	31	94.808	14.376
Total	1.509	287	263.049	27.869

Evaluated Data Dissemination

(as of May 3, 1971)

	Number of data sets		Number of data lines	
	Cumulative total	1970-1971 period	Cumulative total	1970-1971 period
To Area 1	25	0	2.345	0
" " 2	39	0	3.602	0
" " 3	792	200	795.515	345.167
" " 4	414	141	464.966	318.669
Total	1.270	341	1.266.428	663.836

* Excluding EXFOR transmissions

E.2. CINDA

E.2.a. CINDA Publication

CINDA-71 was published for the first time by the Agency on behalf of the four CINDA centres. The appearance of the book was considerably improved by a new printing method, using a Linotron 505 photo-typesetting machine. The steps of the book production were the following: the CINDA master file, which is simultaneously updated at Saclay and Oak Ridge, was provided by the NDCC in a format agreed between NDCC and NDS. At the IAEA, the CINDA file was converted by means of a programme written by Ian Batter-shill/NDS, to a format suitable for input to the Linotron photo-typesetting process. The resulting three magnetic tapes were sent to the Center for Mechanization in Documentation at Frankfurt/Main, where the production run on the Linotron was performed. The output of the Linotron are films of book-page images. These were sent back to Vienna where the books were then produced in offset print on the Agency's printing facility situated in the former Kaiserliche Hofkanzlei of the Vienna Hofburg (= Austrian Emperor's Chancellery).

Since the new method avoids the photographic size reduction of the conventional computer printout, and since the clearer script-face allows 30% more lines per page than previously, even on a smaller page format, the new method turned out to be more economic than the conventional method, notwithstanding the additional costs for renting the Linotron.

Future CINDA publication schedule:

30 August 1971	CINDA-71, Suppl. 1
15 January 1972	CINDA-71, Suppl. 2, including Suppl. 1
1 July 1972	CINDA-72
1 December 1972	CINDA-72, Supplement.

The production of CINDA by IAEA is based on bulk orders of 400 copies by the USAEC and of 500 copies by the ENEA. There is only a small free distribution to CINDA co-workers and INDC-members. Additional copies are sold through the Agency's sales agents.

E.2.b. CINDA coverage

The number of CINDA-entries, which was approximately 55.000 in CINDA-69, has increased to more than 75.000 in CINDA-71. Thus, the annual increase of the number of CINDA-entries was more than double as large as it used to be earlier. This large increase is at least partially due to the fact that during the last years many gaps in the literature coverage were filled. The rate of new literature relevant to CINDA is definitely not decreasing.

In the future, more emphasis seems to be required for preparing CINDA-entries for laboratory-reports from the USA and the USSR.

E.2.c. CINDA development and International Data Index

The Paris 4-Centre Meeting, October 1970, made the following recommendations concerning CINDA (see INDC(NDS)-28/G, p.12):

" It is recommended to CINDA Operators that EXFOR data accession numbers should be included in the CINDA file and in the book, and that they should consider how much further information about the data can reasonably be included ", and

" The group felt that the Centres' data files constitute a publication medium of importance equal to that of other publications referenced in CINDA."

Entering references to EXFOR-entries in CINDA would mean that the publication of data indexes by individual centres like the Saclay Newsletter and CINDU can be discontinued (respectively extracted as a subset from CINDA). This requires however a change of the basic structure of the CINDA-file, but a re-programming of CINDA seems anyway overdue. Extensive CINDA system programming work is presently being done at Saclay and to some extent in Oak Ridge, and some systems analysis has been contributed by NDS. The development of CINDA and its relation to EXFOR will be discussed at the forthcoming Four-Centre Meeting which will take place in Brookhaven, where representatives from the US Cinda Center will be able to participate.

E.3. Inter-centre cooperation

E.3.a. Status of EXFOR and data transmission

Since the end of 1970 the EXFOR data exchange system has reached a fully operational stage and data transmission between the four centres is now proceeding in a regular way.

The scope of EXFOR includes experimental data of all neutron-induced reactions. Thus, EXFOR includes all CINDA-information, except theoretical or evaluated data, and except the two CINDA-quantities "Photo-Fission" and "Gamma, N". However, systematic EXFOR quantity-codes have not yet been developed for most of the fission-fragments data, so that such data cannot yet be entered in EXFOR. This problem will be discussed at the next 4-Centre Meeting.

The procedure established for updating the dictionaries is working satisfactorily, and updated dictionaries are sent out regularly to the other centres from NDS.

The EXFOR Manual describes formats and codes used in EXFOR. The original version of the EXFOR Manual was produced by NDS. This was thoroughly reviewed and updated in detail at the last Four-Centre Meeting in Paris/Saclay in October 1970. Since then the responsibility for the periodical updating of the EXFOR Manual is with NNCSC.

Exchange tapes have been sent from and received by all four centres. Those sent from the NDS have contained mostly data-sets converted from DASTAR, those from CJD have contained mostly new data-sets and, from CCDN and NNCSC, partly old revised sets and partly new data-sets. The table below lists the number of entries and data-lines sent out by each centre to the other three centres as of May 1971.

Centre	Number of entries	Number of sub-entries	Number of data-lines
1. NNCSC	17	99	11,553
2. CCDN	16	256	138,024
3. NDS	82	633	3,117
4. CJD	15	81	782

One EXFOR entry may contain several subentries, the first of which contains bibliographic and descriptive information common to all subsequent subentries. Each of these subsequent subentries contains a data set defined uniquely by element, isotope and data type (= "isoquant").

E.3.b. Compilers' Manual (LEXFOR)

A compilers' manual, which contains the physics definitions and conventions, designed to be of assistance to the EXFOR compiler, is presently being developed to supplement the EXFOR Manual. A first draft of this manual, called LEXFOR, was submitted to the four centres at the Four-Centre Meeting, in October 1970. An updated version of this manual will be issued after receiving comments and contributions from the other three centres. The object of LEXFOR is to achieve a common quality of content and composition of the EXFOR entries prepared by the various compilers.

E.3.c. Four-Centre Meetings

The Sixth Four-Centre Meeting was held in Paris, 5-9 October 1970, between representatives of NNCSC (Brookhaven), CCDN (Saclay) and NDS (Vienna). Unfortunately no representative from CJD (Obninsk) attended the meeting; however, all the decisions and recommendations made during the meeting have since been approved by all four centres (see also reference to December 1970 Meeting below).

The primary subject of discussion was a large number of details regarding the exchange format, EXFOR. In the light of the initial experience gained from the exchange of the trial EXFOR tapes, shortly before the meeting, the participants decided upon a number of minor changes to be implemented immediately in the routine exchange of experimental data.

Among other subjects which were touched upon briefly, were the arrangements for the forthcoming publication of CINDA by the IAEA in Vienna, and other minor questions regarding the coordination of Four Centre functions and activities. The Report on the Sixth Four-Centre Meeting has been published as report INDC(NDS)-28/G. The Agenda of the Meeting is given in Appendix K.

In view of the fact that no representative from Obninsk could attend this meeting, another Four-Centre Consultants Meeting was convened in Vienna, 14-18 December 1970, in which Dr. Popov from CJD (Obninsk), Dr. Zelenkov, Deputy Director of the Kurchatov Institute, Moscow, Dr. Drake from NNCSC, Brookhaven, and Dr. Ribon from Saclay participated (the latter two part-time). The discussions were particularly concerned with the current status of EXFOR data exchange, with the exploration of technical possibilities for the exchange of evaluated data, and with questions of needs and priorities for non-neutron nuclear data including data for safeguards and fusion. In addition the meeting gave a good overview of the current developments and plans in neutron data measurements, compilation and evaluation in the USSR. The highlights of the meeting can be summarized as follows:

1. Growing emphasis is given in the USSR to nuclear data compilation and evaluation. A "Central Nuclear Data Commission" was recently created as a subcommittee of the USSR State Committee on the Peaceful Uses of Atomic Energy, and the Chairman of the Central Commission is Dr. V.A. Kuznetsov, Director of the Institute of Physics and Energetics, Obninsk.

2. The staff of the USSR Nuclear Data Centre located in the Institute of Physics and Energetics, Obninsk, has grown to a total number of 15 which is expected to increase soon to about 20 persons. In addition, a large new computer (M-222) is being installed at the centre for its own use. This will include graphical display facilities and also a special magnetic tape unit for the exchange of tapes with data centres like the Agency's Nuclear Data Section using IBM-type computers. The USSR Centre is fully participating in the international neutron data exchange system EXFOR and has sent the first magnetic tape with USSR data to the Agency's Nuclear Data Section.

3. Work on neutron nuclear data evaluation has started on various topics, and a number of important evaluations will soon be published. Such work, as well as detailed plans for the creation of a USSR Evaluated Nuclear Data Library, will increase the possibilities of a wider degree of evaluated data exchange between the Four Centres. Measures were discussed to coordinate the developing USSR Library with existing libraries in the USA and Western Europe.

4. The USSR is giving full support to the development of an International Request List for Neutron Nuclear Data Measurements and to various other related activities of the Agency's Nuclear Data Section concerning the assessment of nuclear data needs.

5. The USSR participants expressed interest in the international coordination of the compilation, evaluation and exchange of carefully selected "techno-economic" non-neutron nuclear data, like activation analysis data, which are of direct economic importance for all Member States.

The agenda of the meeting is given in Appendix L.

Upon the invitation of the NNCSC, the next Four-Centre Meeting is scheduled to take place at the Brookhaven National Laboratory, 25-29 October 1971. This meeting will be devoted to the review of last year's experience with EXFOR, to discussions of a Four-Centre Data Index, and to an examination of the basic requirements and problems associated with the exchange of computer-based evaluated neutron data libraries.

E.4. Data Reviews

E.4.a. Current status of the 2200 m/sec fission constants review

The recommended values of the 1969 2200 m/s fission constants evaluation by Hanna, Westcott et al., have been adopted by the ENDF/B-file. KEDAK and parts of the UK-file are still using older values. NNCSC expressed the wish that the NDS should prepare a revised set before the end of 1972.

One of the most serious uncertainties of the 1969 evaluation was connected to the U-235 fission cross-section, caused by its dependence on the U-234 α-decay half-life. The recent precision measurement by Deruytter et al. yielded σ_{fo} = 587.9 ± 3.4b in comparison to 580.2 ± 1.8b of the 1969 evaluation. Deruytter's value is based on Spernol's U-234 half-life of (2.445 ± 0.010) * 10^5 years, whereas the 1969 evaluation had used a value of (2.488 ± 0.016) * 10^5 years. The error of Deruytter's result is so small that its weight in a least-squares fit would predominate over all other input data. It would therefore also affect other data, which have been measured relative to the U-235 fission cross-sections, in particular σ_{fo} of U-233. The U-235 capture-to-fission cross-section ratio α will probably be less affected. The absorption cross-section, however, may go up somewhat because Ceulemans et al. reported a scattering cross-section of 14 ± 1 barns, which is lower than the input value of 17. ± 1.7barns used in the 1969 evaluation. The values for Pu-239 still seem to remain valid, because Deruytter's result for this isotope (σ_{fo} = 742.5 ± 3.7 b) confirms the recommended value of the 1969 evaluation (σ_{fo} = 741.6 ± 3.1 b).

The 2200 m/s fission cross-section of Pu-239 was also confirmed by the Romanian group of Petrascu et al., which reported a preliminary value of 741.0 ± 7. b, based on the Pu-239 α-decay half-life, the well-known B-10 (n,α) branching-ratio and the calibration of a γ-spectrometer counting the γ-rays following B-10 (n,α) Li-7*. This experiment was thoroughly reviewed by NDS in contact with Dr. Deruytter, and latest reference-values and questions about possible error-sources were communicated to the authors. As a result, the preliminary value will be lowered by 0.1%. This critical review of a new important experiment should be regarded as an essential function of a data centre. The result of the discussion with the authors is communicated to the scientific community as EXFOR-entry No. 30089, long before final publication.

The situation with respect to $\bar{\nu}$ of Cf-252 remained unchanged. The NDS review of the fission neutron spectra is not likely to change the mean spectra energies used in the 1969 evaluation drastically, so that major corrections in the $\bar{\nu}$-values would not be required. At the Knoxville Conference, in March 1971, de Volpi presented a number of important arguments which will have to be considered, together with many other considerations and new experimental data, in the new 2200 m/s evaluation planned for 1972.

E.4.b. Pu-239 Fission and U-238 Capture Cross-Sections between 1 KeV and 20 MeV

A review is being performed on the Pu-239 fission cross-section and the fission cross-section ratio σ_f Pu-239/σ_f U-235, as well as on the U-238 capture cross section and the capture to fission ratio σ_c (U-238)/σ_f (U-235) from 1 KeV - 20 MeV. The preliminary results of this work were presented by Konshin (NDS) to the Third Conference on Neutron Cross Sections and Technology in Knoxville, Tennessee, 15-17 March 1971, in a paper entitled "IAEA Activities in Reviews of Nuclear Data-Pu-239 Fission and U-238 Capture in the Fast Neutron Energy Region", by T.A. Byer and V.A. Konshin. This review is just about to be completed and the final report (INDC(NDS)-33/U) will be published this summer.

The object of this review has been a thorough examination of all available experimental Pu-239 fission and U-238 capture data, and a subsequent simultaneous evaluation of the fission cross section, the fission ratios and the capture to fission ratios for each of the two considered isotopes between 1 KeV and 10 MeV, in order to obtain for Pu-239, U-238 and U-235 a self-consistency of their cross-sections within known uncertainty limits.

The procedure which has been used in arriving at recommended values for Pu-239 fission cross-sections and Pu-239/U-235 fission cross-section ratios as well as for U-238 capture cross sections and the capture to fission ratios σ_c (U-238)/σ_f (U-235) has been different from that followed by Davey, Hart and Greene et al. These authors all used previously evaluated values of σ_f (U-235) as a "standard" to derive empirical ratios of σ_f (Pu-239)/σ_f (U-235) from the direct σ_f (Pu-239) measurements. They then combined these empirical ratios with the direct (e.g. back-to-back) ratio σ_f (Pu-239)/σ_f (U-235) measurements and used the resulting ensemble of ratio data to arrive at final evaluated ratios for σ_f (Pu-239)/σ_f (U-235). Such evaluated ratios were then recombined with their "standard" σ_f (U-235) values to arrive at recommended values for σ_f (Pu-239). Our approach has been to treat the direct ratio σ_f (Pu-239)/σ_f (U-235) data entirely separately from the direct σ_f (Pu-239) data and then to deduce the U-235 fission cross-section from these two sets of independent results. This deduced σ_f (U-235) result when compared with the existing σ_f (U-235) data provides an important "feed-back" to both the σ_f (Pu-239) and σ_f (Pu-239)/σ_f (U-235) curves, so that we may attempt to adjust these two primary curves, within their limits, so as to try to achieve overall consistency for σ_f (Pu-239), σ_f (Pu-239)/σ_f (U-235) and σ_f (U-235) simultaneously by using this "boot-strap" technique. The same procedure was used for the

evaluation of the U-238 capture cross-section and of the capture to fission ratio σ_c (U-238)/σ_f (U-235), from 1 KeV to 10 MeV, each of them being treated independently of each other as above.

The preliminary conclusions which have been arrived at are:

1. It is not possible to deduce the σ_f (U-235) data of Poenitz between 300 - 850 KeV from the existing ratio σ_f (Pu-239)/σ_f (U-235) and σ_f (Pu-239) data. To arrive at Poenitz's σ_f (U-235) data in this energy region would require a ratio curve about 10% higher than all the ratio data and simultaneously a σ_f (Pu-239) curve about 8% lower than the lowest direct σ_f (Pu-239) data.

2. In the energy region from 30 - 150 KeV the ratio data of Pfletschinger and Käppeler and Allen and Ferguson, the σ_f (Pu-239) data of Szabo et al. and the σ_f (U-235) data of Lemley et al., Szabo et al., and White (except the 40 KeV point of White appear to define a consistent set, in that the product of the curves through any two of these three types of cross-sections will generate the third set of cross-sections.

3. In the energy region from 200 - 800 KeV it is well known that the σ_f (U-235) values deduced from the σ_γ (Au-197) and σ_γ (Au-197)/σ_f (U-235) data are much lower than the σ_f (U-235) data of White and Szabo et al. Indeed, this has been one of the arguments used by Poenitz in favour of his σ_f (U-235) data. Because of the conclusions arrived at in 1. and 2. above, it appears that there is a fundamental inconsistency between the σ_f (Pu-239)/σ_f (U-235), σ_f (Pu-239), σ_γ (Au-197) and σ_γ (Au-197)/σ_f (U-235) data in this region.

E.4.c. Pu-239 capture to fission ratio

One of the recommendations which resulted from the IAEA experts meeting on the "Present status of the α (Pu-239) values", held at Studsvik, Sweden, in June 1970, was that the IAEA, " ... through its Nuclear Data Section, should collect all these (α) data and experimental conditions and publish an improved review of all available α data ... " (see INDC(NDS)-25/L, August 1970). As a result of this recommendation, V.A. Konshin (IAEA/NDS) together with M.G. Sowerby (Harwell) have undertaken a thorough review and evaluation of the available Pu-239 capture to fission ratio data in the energy range above 100 eV. The energy region below 100 eV has not been considered in this review because this energy range cannot be divorced from a discussion of individual resonance parameters, and the data at thermal energies have recently been considered in detail.

This review paper, which will be published in the Atomic Energy Review (possibly in September 1971), consists of a thorough analysis of the available experimental data, their interpretation and an evaluation of "alpha". The resultant set of evaluated "alpha" values, between 0.1 KeV and 1 MeV, will be arrived at by the authors as a result of detailed considerations of each experiment and extensive consultations with all the other "alpha"-experimentalists involved. A pre-publication draft will be issued as

report INDC(NDS)-32/L at the time of the INDC meeting.

E.4.d. Status of $\bar{\nu}$ (E) data

Following the recommendations of the IAEA Consultants Meeting on $\bar{\nu}$ values for fissile nuclides held in Studsvik, Sweden, in June 1970, confirmed at the last INDC Meeting in Vienna, NDS has continued its compilation of $\bar{\nu}$ values in order to include in its review all those isotopes not yet considered in the preliminary review by Konshin and Manero, INDC(NDS)-19/N, submitted to the above meeting.

The new data taken in consideration in this review are:

a) Energy dependent values of $\bar{\nu}$ for Th-232, U-234, U-236, U-238 and Pu-240.

b) Thermal values for all the isotopes from Th-232 to Cf-252.

c) Average number of delayed neutrons as a function of energy for all the fissile nuclei.

d) Up-dating of the information on $\bar{\nu}$ for spontaneous fission.

For all these isotopes, for which energy dependent values of $\bar{\nu}$ exist, a weighted least-squares orthogonal-polynomial fitting (see paragraph E.4.f) was applied in order to get the best fit to the experimental data.

Only in the case of U-235, U-238 and Pu-239, for which the amount of experimental data is large and covers the whole energy range from thermal to 15 MeV, was a higher degree fitting justified; for the remaining isotopes so few data are available that only a linear fit appeared to be justified.

In the case of U-238 and Pu-239 the experimental data between thermal and 15 MeV are well represented by a 3rd degree polynomial; for U-235 the fitting confirmed the existence of a structure in the low energy region.

It should be mentioned that the actual values of the fitted parameters are strongly linked to the absolute values of the standards used, i.e. the spontaneous $\bar{\nu}$ for Cf-252 and the thermal values of the main fissile isotopes. For the moment more reliable values for these quantities are those given in the review of Hanna et al., because no new experimental values have been published since then. It should be mentioned in this context that de Volpi has started a revision of these fundamental fission parameters and that his provisional values are about 1% lower than those of Hanna et al.

This review will be published by NDS as report INDC(NDS)-34/L.

E.4.e. Prompt Fission Neutron Spectra Review

In response to recommendations by EANDC and INDC a start was made during the last quarter of 1970 on the review of the prompt fission neutron spectra for the U-235, Pu-239 and Cf-252 isotopes. Initially this entailed a thorough literature search and sending out requests to authors for the experimental data, because of the non-availability of these data in the centres. Unfortunately only a small number of experimental data sets was received upon these requests; a considerable portion of the rest does no more exist. The literature search is practically completed and a few more data sets were taken from the literature. The reason for collecting these data is that it is hoped that by combining the different data sets, enough points may be available to apply integration techniques and obtain the average spectrum energy independently of any assumptions as to the spectrum shape.

This integration procedure, consisting of a series of consecutive computer calculations, required a certain amount of programme development. Although reasonable progress has been made, several problems still remain to be solved before a reliable figure for the average energy can be given. Because of the larger abundance of data available for U-235, it was selected to be used as the test case for this programme. After the successful completion of the proposed calculations, this procedure will also be applied to Pu-239 and Cf-252 data.

The results of the above calculations, and a collection of the relevant information on all published experiments, for the three considered isotopes are expected to be published (INDC(NDS)-35/L) as a review to be presented at the consultants meeting on this subject in August 1971 in Vienna.

E.4.f. Fission Threshold Reactions

As part of its general objective to survey important data needs in specific fields, the NDS has performed a preliminary review of three fission threshold reactions of particular interest to reactor radiation dosimetry and of relevance to the discussion of the discrepancy between differential and integral determinations of prompt fission neutron spectra.

The experimental fission cross-section data of U-238, Np-237 and Th-232, published up to the end of 1970, have been reviewed and analyzed between their respective thresholds and 20.0 MeV. A statistical analysis of these data, performed with a Weighted Least-Squares Orthogonal Polynomial Fitting computer programme, has yielded point-wise cross-sections with associated uncertainties based on a 95% statistical confidence level. An approximate calculation of the fission spectrum weighted average fission cross-section values of U-238, Np-237 and Th-232 and their uncertainties was performed with the point-wise data obtained from the fitting procedure. Compared to most of the published data, the fission spectrum integrated cross sections are lower. This could possibly reflect too low a σ_f (U-235) curve used in the normalization of the considered threshold reactions.

A more thorough analysis of these data, including the latest data, in particular the Karlsruhe measurements by Cierjacks, is planned to be performed and published as INDC document INDC(NDS)-36/L in the course of this year.

E.4.g. Thermal data of the main Pu isotopes and their fission products

The IAEA Division of Nuclear Power and Reactors convened in Vienna, 21-25 June 1971, a Panel on "Plutonium Recycling in Thermal Power Reactors". The NDS was invited to present a review on the nuclear characteristics of the main Pu-isotopes in a thermal reactor spectrum, including the nuclear characteristics of the main fission products. For this purpose the NDS prepared a compilation of relevant evaluated data and most recent experimental data together with a brief discussion of the main sources of uncertainties. Copies of this report are made available to INDC Members; it will be published as report INDC(NDS)-40/U and in the proceedings of the above panel.

E.4.h. Fitting Programme used in NDS reviews

The computational tool which has been applied to all of the reviews performed to-date by NDS (see sections E.4.b through f, above), is a "Weighted Least-Squares Orthogonal Polynomial Fitting Programme", which had been developed and used at CERN, Geneva.

This programme, written for the IBM 7090 computer, and adapted to the IAEA IBM-360/30, allows for statistical fitting of experimental data, together with their errors, yielding "best value" curves of the fitted data together with an estimate of point-wise and regional statistically determined standard deviations based on any desired confidence level. One essential feature of this programme, is that it uses orthogonal polynomials allowing a high degree of fitting (up to degree 40) without excessive use of computer time.

Although statistical fitting programmes, such as the one used in this analysis, are powerful tools for efficient and rapid processing of experimental data, one must realize that a statistical approach dealing not exclusively with statistical errors sometimes disregards and often does not do justice to the underlying physics. Furthermore, these methods treat the uncertainties attached to the data, whether their origin is systematic or random, in a purely statistical way. The situation is aggravated more in that the data, and specifically the uncertainties assigned to the data, are not always specified by the authors as being either systematic or statistical, at best one single error is usually given.

* * *

APPENDIX A

List of Current Liaison Officers to the INDC

May 1971

Austria	Weinzierl, P.
Belgium	Nève de Mevergnies, M.
Bolivia	Paz Lora, F.
Brazil	Herdade, S.B.
Bulgaria	Nadjakov, E.
Chile	Martens Cook, P.
China	Chien, Ji-Peng
Colombia	Director, Instituto de Asuntos Nucleares
Congo	Pollak, H.
Czechoslovakia	Rocek, J.
Ecuador	Grossmann, E.
Finland	Palmgren, A.
Greece	Dritsa, S.
Hungary	Kluge, Gyula
Iran	Rouhaninejad, H.
Iraq	Almallah, M.Y.
Israel	Ben-David, G.
Jamaica	Chen, A.A.
Kenya	Gacii, P.
Korea	Chung, Mun-Kyu
Mexico	Graef Fernandez, C.
Netherlands	Bustraan, M.
Norway	Andersen, E.
Pakistan	Islam, M.
Philippines	Navarro, Qu.O.
Poland	Sujkowski, Z.
Portugal	Carvalho, G.F.
Romania	Rapeanu, S.
South Africa	Reitmann, D.
Spain	Velarde, G.
Switzerland	Huerlimann, Th.
Thailand	Areebhol, P.
Turkey	Enginol, T.
U.A.R.	El-Nady, M.
Uruguay	Aziz, N.
Viet-Nam	Vo-Xuan-Bang

APPENDIX B

STUDY GROUP MEETING ON THE UTILIZATION OF LOW ENERGY ACCELERATORS IN LATIN AMERICA, RIO DE JANEIRO, 15 - 19 MARCH 1971

List of Participants

BRAZIL:

J. Goldemberg, Univ. de São Paulo
A. Moreira, CBPF, Rio de Janeiro
A. Pinho, Pontificia Universidade Catolica do Rio de Janeiro
O. Sala, Univ. de São Paulo
N.V. de Castro Faria, PUC, Rio
B. Patnaik, PUC, Rio
J. Danon, CBPF, Rio
S. de Barros, CBPF, Rio
A.M. de Oliveira, CBPF, Rio
R.P.A. Muniz, CBPF, Rio
R. Douglas, Univ. de São Paulo
E. Hamburger, Univ. de São Paulo
I. Cunha, Univ. de São Paulo
F. Zawislak, Univ. Federal do (Porto Alegre)Rio Grande do Sul
J.C. Valadão, Instituto Militar de Engenharia, Rio

MEXICO:

J. Calvillo, Inst.Politec.Nac., Mex.D.F.
A. López, Univ. de Guanajuato
M. Nazari, UNAM, Mexico D.F.
J. Rickards, UNAM, Mexico

UK:

G. Dearnaley, AERE, Harwell

UNESCO:

A. Forti, Paris

IAEA:

S. L. Whetstone, Vienna

ARGENTINA:

H.M. Antúnez, Centro Atómico Bariloche
W. Meckbach, Centro Atómico Bariloche
E. Pérez Ferreira, CNEA, Buenos Aires
M. J. Sametband, CNEA, Buenos Aires
E.E. Smolko, CNEA, Buenos Aires

CHILE:

J.L. Romero, Univ. de Chile, Santiago
J. Zamudio, Univ. de Chile, Santiago
T.W. Conlon, Univ. de Chile, Santiago

COLOMBIA:

J. Herkrath, Universidad de los Andes, Bogota

PERU:

V. Latorre, Univ. Nacional de Ingenieria, Lima

CLAF:

R.B. da Costa, CLAF, Rio
D.V. Ferreira, CLAF, Rio

USAEC, Rio Branch:

R. Wilcox, American Embassy, Rio

USA:

J.R. Boyster, Science Applic., La Jolla, Calif.
R.B. Leachman, Kansas State University

FRG:

K.-H. Lindenberg, Hahn-Meitner Inst., Berlin

List of Accelerators in Latin America

(Expected to be in use during 1971)

ARGENTINA

I. Centro Atomico Bariloche, Comision Nacional de Fisica, San Carlos de Bariloche

1. Linear Accelerator 15-25 MeV electrons
2. Van de Graaff 0.5-2 MeV (+) to operate in 1971
3. Cockcroft-Walton 30-380 KeV (+)

II. Comision Nacional de Energia Atomica, Buenos Aires

1. Synchrocyclotron 14 MeV p, 28 MeV d, 55 MeV alpha
2. Cockcroft-Walton 1.2 MeV d

BRAZIL

I. Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro

1. Linear Accelerator 5-32 MeV electrons

II. Escola de Engenharia de Sao Carlos, São Paulo

1. Linear Accelerator 2 MeV electrons

III. Pontificia Universidade Catolica, Rio de Janeiro

1. Van de Graaff (KN) 0.5-4 MeV(+),1.5-3.0 MeV electrons

IV. Universidad de São Paulo, São Paulo

1. Linear Accelerator, 50 MeV electrons
2. Betatron 22 MeV electrons
3. Tandem Van de Graaff (MEC, 3-stage), 22 MeV p, ...
4. Van de Graaff, 3 MeV, p, d, $^{3}He^{+}$, $^{4}He^{+}$

CHILE

I. Universidad de Chile, Santiago

1. Isochronous cyclotron 2-10 MeV p, 1.5-5.5 MeV d, 8-16 MeV alpha, 10-16 MeV ^{3}He
2. Cockcroft Walton 800 KeV (+)

MEXICO

I. Centro Nuclear de Mexico, Comision Nacional de Energia Nuclear, Mexico D.F.

1. Tandem Van de Graaff (EN), 12 MeV p, ...

II. Instituto de Fisica, Universidad Nacional Autonoma de Mexico, Mexico D.F.

1. Dinamitron 0.5-2.5 MeV, p, d, ^{3}He, ^{4}He
2. Van de Graaff, 2 MeV electrons
3. Cockcroft-Walton 150 KeV (+)

III. Universidad de Guanajuato

1. Van de Graaff, 0.5 MeV electrons

IV. Instituto Politecnico Nacional, Mexico D.F.

1. SAMES Neut. Gen., 150 KeV (+)

RADIOTHERAPY MACHINES EXCLUDED

RECOMMENDATIONS FROM THE PARTICIPANTS OF THE STUDY GROUP MEETING ON THE UTILIZATION OF LOW ENERGY ACCELERATORS IN LATIN AMERICA

A - INTRODUCTION

The participants of the Study Group Meeting on the Utilization of Low Energy Accelerators in Latin America consider it necessary to maintain and reinforce programmes of basic and applied research involving the use of accelerators. This is important mainly because:

1st. The use of such installations opens a wide field of research not only in studies of nuclear problems, but also in atomic physics and other specific subjects.

2nd. The use of techniques and methods applied in research programmes with accelerators has allowed the preparation of personnel whose training is particularly important to the development of modern technology.

The participants consider that this meeting will have accomplished one of its most important objectives if it stimulates a regional cooperation in Latin America for the use of accelerators, as well as a more efficient use of existing installations.

B - RECOMMENDATIONS

I - RECOMMENDATIONS TO THE INTERNATIONAL ATOMIC ENERGY AGENCY

1. To maintain and reinforce the already established relations with the Latin American Centre for Physics. In view of the success of this meeting, the participants suggest that joint programmes be established between the International Atomic Energy Agency and the Latin American Centre for Physics in the near future.

2. To co-sponsor with the Latin American Centre for Physics regular meetings of accelerators users in Latin America. The next meeting should be held in two years.

3. To endorse fellowships for Latin American graduate students in fields requiring the use of accelerators.

4. To sponsor visiting experts in the use of accelerators.

5. To help establish channels for expediting transit of scientific equipment through customs of the Member States, and for simplifying the procedures required by governments for scientific personnel entering or leaving the countries.

APPENDIX C

Nuclear Data for Reactor Radiation Measurements

Regarding cross section data on neutron reactions used in reactor dosimetry and other relevant nuclear data, the Working Group noted that :

a) There are discrepancies and gaps in the experimental information;
b) Different values for evaluated data are used in various laboratories;
c) At present, no reference set of nuclear data has found general acceptance.

In order to improve the situation, the Working Group recommends to the IAEA to take appropriate steps in order to arrive at internationally acceptable reference values for those neutron reactions of primary importance for radiation effects investigations in nuclear reactors.

In a first approach, the Nuclear Data Section of the IAEA should prepare a Status Report on Neutron Cross Section Data, commonly used in reactor dosimetry and irradiation effects investigations and distribute it three months before the next meeting for the Members of the Working Group, and Subgroup I.

This Status Report should serve as a basis for the preparation of recommendations and establishing priorities for further experimental and evaluation work. The list of data to be covered should be based on relevant information submitted to this meeting of the Working Group and should be checked by Mr. P. Mas and W. Zijp.

APPENDIX D

Provisional Agenda

for the IAEA Panel on Neutron Nuclear Data Evaluation

1. Evaluation activities in Member States, important evaluation needs and the assessment of these needs

2. Status and quality control of evaluations:
   - A. Status of existing evaluated data libraries
   - B. Quality control - format, consistency and physical checks - influence of macroscopic experiments and adjustments to evaluated data sets

3. Basic rules of neutron nuclear data evaluation:
   - A. Comparison of experiments and the criteria used to characterize agreement
   - B. Handling of discrepant experimental data
   - C. Weighting and fitting procedures
   - D. Reference standards used in evaluation
   - E. Documentation of evaluations
   - F. Assessment of the errors of evaluated data

4. Establishment of computer libraries of evaluated data and associated computer programmes:
   - A. Formats, editing and user programmes
   - B. Practical problems of representation of evaluated data
   - C. Technical problems connected with the exchange of evaluated data libraries - conversion from one format to another

5. Role and efficiency of nuclear theory in evaluation
   - I. Resolved and Unresolved resonances:
     - A. Present status and formalisms used
     - B. Experiences, limitations and achievements in the application of theory to resolved resonance evaluation
     - C. Energy and spin dependence and systematics of average resonance parameters
     - D. Importance of resonance interference and intermediate structure in fission on the Doppler effect
     - E. Representation of resolved and unresolved resonance data

II. Statistical, Optical and Direct Interaction Models:

A. Availability, quality of and estimated computer time for computer codes

B. Physical adequacy and convenience of data representation

C. Comparison of computer codes - possible reasons for discrepant results

6. International cooperation in evaluation, coordination of evaluation activities and possible improvements in the international exchange of evaluated data.

APPENDIX E

INTERNATIONAL ATOMIC ENERGY AGENCY
AGENCE INTERNATIONALE DE L'ENERGIE ATOMIQUE
МЕЖДУНАРОДНОЕ АГЕНТСТВО ПО АТОМНОЙ ЭНЕРГИИ
ORGANISMO INTERNACIONAL DE ENERGIA ATOMICA

KÄRNTNER RING 11, P.O. BOX 590, A-1011 VIENNA, AUSTRIA

TELEPHONE: 52 45 11
52 45 25
TELEX. 01-2645
CABLE INATOM VIENNA

IN REPLY PLEASE REFER TO
PRIERE DE RAPPELER LA REFERENCE-

11 May 1971

Dear

In accordance with the recommendation of the International Nuclear Data Committee, the International Atomic Energy Agency will convene a panel of experts on the subject of Neutron Nuclear Data Evaluation at the Agency's Headquarters in Vienna from 30 August to 3 September 1971. The objectives of the panel are to review the methods, quality and present status of neutron nuclear data evaluation, as well as to examine the basic requirements and problems associated with establishing and exchanging evaluated neutron data libraries. The panel will be asked to report to the Director General of the Agency on the current status of the topics discussed and to recommend guidelines for the Agency's future programme in this regard. The Provisional Agenda for the panel is attached. *)

For the first item of the Provisional Agenda, the Nuclear Data Section will prepare a review of the neutron data evaluation activities, the important evaluation needs and the assessment of these needs in Member States. The success of this review clearly depends upon the relevant information being made available to the Agency. In this context we would greatly appreciate if you could complete the questionnaires in Annexes I and II and supply any other pertinent information on the evaluation activities and/or evaluation needs in your country. If you are not in a position to supply us with the relevant information, we would greatly appreciate if you forward this letter to the appropriate person(s) for action.

So as to allow sufficient time for the completion of this review prior to the panel, we would urge you to send us your reply as soon as possible so as to reach us not later than 9 July 1971. If you need any further clarification regarding the contents of Annexes I and II, please feel free to contact us immediately.

Thanking you for your cooperation,

Yours sincerely,

J.J. Schmidt, Head
Nuclear Data Section
Division of Research
and Laboratories

Enclosures

*) for provisional agenda
see pp. 45-46 (App.D)

Annex I

I. Review of the Important Neutron Data Evaluation Needs and the Assessment of these Needs in Member States

The information required under this item is related to the following four questions:

1. How does your country go about identifying its neutron data evaluation requirements ?

2. Who are the users of evaluated neutron data in your country ?

3. How far do the existing evaluated neutron data libraries meet the needs of the users in your country ?

4. For those Member States that do not have a neutron data evaluation programme, what are the needs for such data in your country ?

Annex II

II. Review of the Neutron Nuclear Data Evaluation Activities in Member States

Under this item information related to four basic questions is required:

1. The neutron data evaluation work in progress at present and that which will be started before the end of 1971 ? - (Specimen reply given in Table II.1).

2. The computer programmes and codes available ? - (Further specifications given in Table II.2).

3. The Laboratories/Institutes involved in the evaluation effort (Tables II.1 and II.3); the organization and co-ordination of the evaluation work between these Laboratories/Institutes (Table II.4) and the total manpower available for the evaluation effort (Table II.3) ?

4. Does your country collaborate, bilaterally or multilaterally, with other States in co-ordinating, organizing and performing evaluations ? If so, please indicate in what form (e.g., contracts, committees, newsletters) and on what subjects does this collaboration manifest itself.

Table II.1

Work in Progress (I) and Work Planned (II) during the next 6 months.

Nuclide	Cross Section Type	Energy Range	Evaluators' Names (Laboratory)
Pu-239 (I)	α, $\bar{\nu}$, σ_f	Thermal - 15 MeV	..... (...)
U-238 (II)	All reaction types	1 KeV - 20 MeV	..... (...)
Au-197 (II)	$\sigma_{n,\gamma}$	1 KeV - 10 MeV	..... (...)
Na (I)	All reaction types	1 KeV - 15 MeV	..... (...)
Fission Products	$\sigma_{n,\gamma}$	1 KeV - 10 MeV	..... (...)

Table II.2

A. What computer facilities are available for performing evaluations and for handling evaluated data libraries ?

B. What evaluated neutron data libraries are used in your country and what are their formats ?

C. What are the contents of these libraries ?

D. What computer programmes and calculational codes are available for:

1. Evaluated data handling (e.g., checking, editing, updating, etc.) ?

2. The analysis and calculation of cross-sections ?

3. Format conversion from one evaluated data library to another ?

Table II.3

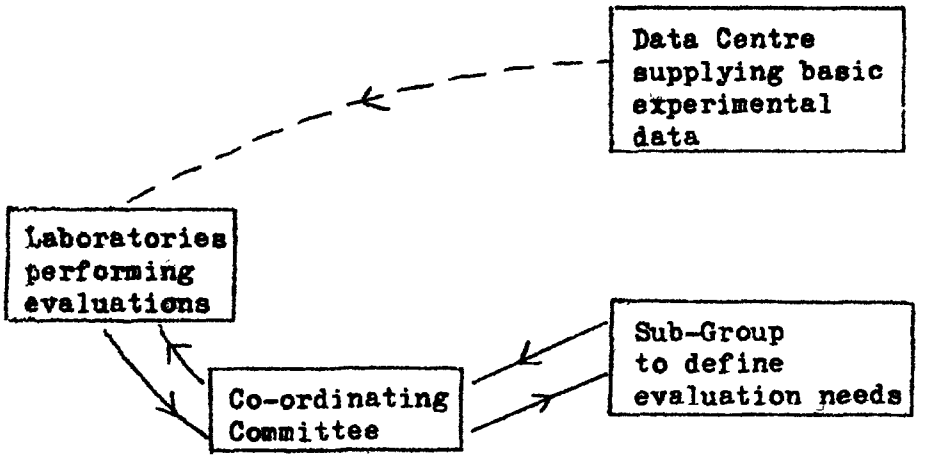
Laboratories/Institutes Involved in the National Evaluation Effort and the Manpower Available to Support this Effort

Laboratory/Institute	Total Manpower Available for Evaluation (man-months of post-graduate staff)	
	at present	in 1972

Table II.4

Organization and Co-ordination of National Evaluation Effort.

The chart below gives a schematic outline of a possible organization of a national neutron data evaluation programme. We would appreciate it if you could draw up the chart valid for your country.



APPENDIX F

First Meeting of the International Working Group
on the Compilation, Evaluation and Dissemination
of Nuclear Structure and Reaction Data

24 - 28 January 1972

PROVISIONAL AGENDA

1. Opening and announcements

2. Organization, general data scope, title of the Working Group, etc.

3. Needs in the user communities

   a) Status of surveys of needs; kind, depth and form of the needed information; first results and conclusions

   b) Priorities; particularly high priority needs.

4. Compilation of experimental data

   a) Current status of compilation activities including scope and depth of compiled data and related information; level of computer use, available staff and funds, etc.

   b) Feasibility of extending the collaboration on the collection of data and related information from experimentalists

   c) Needs for agreements on formats for exchange of compiled data and related information and possible ways of implementation

5. Evaluation

   a) Current status of evaluation work, including manpower, equipment and funds available for the purpose. Special attention should be given to those phases of the evaluation works, which are the greatest "mechanical" obstacles, and which are potential fields of improvements in a cooperative effort.

   b) Evaluation methods, criteria and documentation.

   c) Feasibility of compatible computer formats and files for evaluated data.

6. Recommendation to authors, editors and journal reviewers regarding requirements on content of publications on nuclear physics experiments.

7. Dissemination; optimization of information transfer between nuclear data centres and users.

8. Feasibility of a "Non-neutron CINDA".

9. A program for longer-term (meaning at least a couple of years) activities of the Working Group, to take full account of the recommendations of the Nov. 1970 Consultants Meeting as revised at this meeting.

10. Summary of actions and recommendations

APPENDIX G

INTERNATIONAL ATOMIC ENERGY AGENCY
AGENCE INTERNATIONALE DE L'ENERGIE ATOMIQUE
МЕЖДУНАРОДНОЕ АГЕНТСТВО ПО АТОМНОЙ ЭНЕРГИИ
ORGANISMO INTERNACIONAL DE ENERGIA ATOMICA

KÄRNTNER RING 11, P.O. BOX 590, A-1011 VIENNA, AUSTRIA

TELEPHONE 52 45 11
52 45 25
TELEX 01-2645
CABLE INATOM VIENNA

IN REPLY PLEASE REFER TO
PRIÈRE DE RAPPELER LA RÉFÉRENCE

23 October 1970

Dear Sir,

At the last meeting of the International Nuclear Data Committee (INDC), which acts as an advisory body to the Director General of the International Atomic Energy Agency (IAEA) on all matters pertaining to nuclear data, the role of basic nuclear data in the technical development of nuclear fusion reactors was discussed. The Committee felt that it would be particularly helpful if it could be supplied with more specific definitions and priorities of the actual nuclear data needs for fusion reactor development, with particular reference being made to the merits of the existing neutron data request lists which have, to-date, been primarily oriented towards the data needs for fission reactor research and development.

Such a list of needs could serve to stimulate further experimental effort, internationally coordinated by the IAEA, towards performing those measurements on nuclear materials for which existing data are either inconsistent, incomplete or unknown. In addition, it could also serve the purpose of initiating reviews and evaluations for those classes of data regarded as being of prime importance.

In this context, we would find it particularly helpful if you could provide us with your comments on, as well as a list of, such present and future data needs, and at the same time refer us to those scientists in your country who are actively engaged in fusion reactor research in which nuclear data play an important part.

The views on and lists of specific data needs which are transmitted to the Agency in response to this enquiry, will be submitted to the next meeting of the INDC, July 1971, following which the Committee may arrive at specific recommendations, which could then lead to actions along the lines referred to above. We would be grateful if you could send us your reply by 15 December 1970, so as to allow both the Agency and the members of the INDC sufficient time to assess the situation in preparation for the July meeting of the Committee.

Looking forward to your reply,

Yours sincerely,

Alex Lorenz
Nuclear Data Section
Div. of Res. & Laboratories

List of distribution for letter on fusion data from A. Lorenz of 23 October 1970:

Name	Address	Country
Dr. C.N. Watson-Munro	School of Physics University of Sydney Sydney	Australia
Dr. P. Hubert	Centre d'Etudes Nucléaires B.P. No 6 92 Fontenay-aux-Roses	France
Dr. G. von Gierke	Institut für Plasmaphysik 8046 Garching, München	F.R.G.
Dr. B. Brunelli	CNEN, Laboratorio Gas Ionizzati Frascati, Rome	Italy
Dr. K. Uo	Plasma Physics Laboratory Kyoto University Kyoto	Japan
Dr. C.M. Braams	FOM Institute for Plasma Physics Rijnhuizen, Jutphaas	Netherlands
Dr. B. Lehnert	Kungl. Tekniska Högskolan Inst. för Plasma Physics Stockholm 70	Sweden
Dr. R.S. Pease	UKAEA, Culham Laboratory Abington, Berks.	U.K.
Dr. Roy Gould	USAEC, Division of Research Controlled Thermonuclear Research Washington D.C. 20545	USA
Acad. L.A. Artsimovich	Kurchatov Institute of Atomic Energy, Moscow	USSR

APPENDIX H

Research Contract No. 995/TC.

The following information will be collected on each assay technique:

1. Physical principles of the measurement;
2. Fissile material under assay;
3. Range of gram quantities of materials in samples and corresponding precision attained in analysis;
4. Physical and chemical form of the sample;
5. Composition of the other material present;
6. Homogeneity of the sample;
7. Principle sources of background encountered;
8. Self-shielding problems for neutrons and/or γ-rays;
9. Container (or sample) size and composition;
10. Standards needed:
11. Quantity of material handled on a product basis with the instrument;
12. Others.

In addition, the assay techniques which have been used or are being developed for nuclear materials assay include:

1. Measurement of characteristic X-rays;
2. α-particle counting and α-spectroscopy;
3. Passive γ-scans -NaI-detectors;
4. Passive γ-scans - Ge(Li) detectors;
5. Passive γ-scans - Si(Li) detectors;
6. γ-ray attenuation;
7. Neutron attenuation;
8. Neutron self-indication;
9. Calorimetry;
10. (α,n) neutron analysis;
11. Fission neutron coincidence analysis;
12. Interrogation with radioactive sources: Cf-252, PoLi, PuBe, SbBe, PoBe;
13. Subthreshold neutron interrogation, electron source;
14. Subthreshold neutron interrogation, positive ion source;
15. 14 MeV neutron source, delayed neutron yield;
16. Delayed neutron kinetics method.

APPENDIX I

INTERNATIONAL ATOMIC ENERGY AGENCY
AGENCE INTERNATIONALE DE L'ENERGIE ATOMIQUE
МЕЖДУНАРОДНОЕ АГЕНТСТВО ПО АТОМНОЙ ЭНЕРГИИ
ORGANISMO INTERNACIONAL DE ENERGIA ATOMICA

KÄRNTNER RING 11, P.O BOX 590, A-1011 VIENNA, AUSTRIA

TELEPHONE 52 45 11
52 45 25

TELEX: 01-2645

CABLE: INATOM VIENNA

IN REPLY PLEASE REFER TO
PRIÈRE DE RAPPELER LA RÉFÉRENCE

DAT/343

14 May 1971

Dear Colleague,

During the first half of 1970, a survey was made of the needs for accelerator targets and samples for nuclear data experiments (our first letter was sent out on 10 December 1969). The results of this survey, as presented to the International Nuclear Data Committee (INDC), showed clearly that some remedial action is called for. As a consequence the Nuclear Data Section of the IAEA is trying to find ways and means to support the acquisition of such targets and samples, whenever applicable on a loan basis.

We now have reason to believe that some limited means will be made available already 1972 to start a small programme for this purpose. In accordance with their recommendation adopted in 1970, the INDC will review all requests in this programme. The adopted policy and procedure are given in the enclosed document. If you (or anyone else at your Institute) find it impossible to acquire samples or targets in other ways you are invited to submit a request listing your needs. Such a list should be given with as much pertinent information as possible, and should particularly contain in detail:

1. The purpose for which the targets are needed. This should include a short description of the experiment, as planned, its time-scale and perhaps a reference to any related published work. Projected accuracies of results may be important in the review of the requests.

2. The type of facility at which the experiment will be performed.

3. The desired specifications and/or range of tolerable specifications of the required targets. Note particularly for sample and for backing:

a) geometrical specifications
b) chemical specifications

whenever possible.

4. The financial arrangements made (funds granted or applied for) in support of the experiment. Indicate also specifically whether or not the funding of the samples is expected to present a problem; often the currency appears to be a greater problem than the funds.

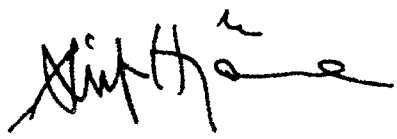
In view of the very limited means available, the requests will be carefully screened, and some criteria which will be used by INDC have been indicated in their policy recommendation. Briefly, this means that preference will be given to measurements related to urgent needs in applied nuclear science and technology. For neutron data it is suggested that experimentalists consult the following two documents which are implicitly referred to in the enclosed document:

- RENDA: EANDC 85 "U" (April 1970)
- Non-EANDC request list for neutron nuclear data measurements (to be published during the second half of 1971).

It should be pointed out that INDC will only consider requests submitted through the competent Government authority to the IAEA. In the interest of a rapid handling of the requests, the requestor should simultaneously send an information copy directly to the Nuclear Data Section of the IAEA.

The next meeting of the INDC will take place in Bombay, 12 - 16 July 1971, and it would be advantageous, if we could have at least preliminary information as soon as possible.

Yours sincerely,



Leif Hjärne
Nuclear Data Section
Div. of Research and
Laboratories

Enclosure

FINAL RECOMMENDATION FROM THE INDC

February 1971

Recommended Policy and Procedures for the Handling of Requests for Targets and Samples for Nuclear Data Measurements

A. Policy for Evaluation of Requests

The requests may be classified into three categories as follows:

Category A: Requests for targets and samples needed for nuclear data measurements corresponding to priorities 1 and 2 in the current carefully examined and approved neutron data measurement request lists (e.g. RENDA) and to first priority data requests (as defined below) for the scientific and technical development in areas such as safeguards and nuclear fusion.

Category B: Requests for targets and samples needed for nuclear data measurements corresponding to lower priority requests in the request lists and subject areas mentioned in Category A, and to less urgent data needs for applied nuclear purposes.

Category C: Requests for targets and samples needed for nuclear data measurements not covered by Categories A and B.

Requests in Category A, and in exceptional cases also in Category B, should be considered for direct funding or other applicable support by the IAEA. Requests in Category C, and normally also in Category B, should not be considered for direct funding.

For inclusion in Category A there can also be considered other subject areas in the general field of peaceful uses of nuclear energy of vital interest to the program of the IAEA. The inclusion of high priority requests for data for such a subject field in Category A can be made by the IAEA contingent upon the recommendation of an advisory body. Appropriate priorities explicitly defined and vouched for by such an advisory body as well as the careful examination and approval of the data requests by the same or other advisory bodies will be a prerequisite for the inclusion.

All requests will be considered and carefully evaluated by the INDC. Regarding those requests which cannot be funded or otherwise supported directly by the IAEA, suggestions may be given by INDC members to the requestors as to other possible methods for the procurement of targets and samples. The IAEA should assist the requestors in this procurement by correspondence, if necessary.

B. Procedure for Evaluation of Requests

In order to be considered by the INDC, requests for targets and samples should be submitted formally through the cognizant Government authority to the IAEA. The Nuclear Data Section of the IAEA is asked to take the appropriate steps to ensure this and to keep the INDC members informed.

The requests should be categorized and compiled by the Nuclear Data Section and sent to the members of the INDC by the Scientific Secretary. This should be done on a quarterly or half-yearly basis, depending on the number of requests.

The members of the INDC should convey their comments to the Chairman of INDC within a period of two months and send copies to the Executive and Scientific Secretaries of the INDC.

The Scientific Secretary should prepare a summary report, including draft recommendations, and circulate it to the INDC members, after consultation with outside experts, if necessary.

The Chairman of the INDC will submit those recommendations, on which, in his opinion, a consensus has been reached, to the Director General of the IAEA. Other cases should be taken up at the following INDC meeting.

APPENDIX J

REGIONAL FIELD TRIP TO EASTERN EUROPEAN INSTITUTES

Following the field trips of NDS representatives to Asia and Australia, and South America in 1968 and 1969, a regional field trip was undertaken by H.D. Lemmel (NDS) to the following nuclear physics laboratories in Eastern Europe, during the month of November 1970:

Czechoslovakia:	Nuclear Research Institute, Rež near Prague
Poland:	Institute of Nuclear Research, Swierk and Warsaw Institute of Nuclear Physics, Cracow
Hungary:	Central Research Institute of Physics, Budapest University Institute of Experimental Physics and Institute of Nuclear Research, Debrecen
Romania:	Institute of Atomic Physics, Bucharest
Bulgaria:	Institute of Physics, Sofia
Yugoslavia:	Institute "Boris Kidric", Vinča near Beograd Institute "Ruder Boskovic", Zagreb Institute "Jozef Stefan", Ljubljana.

At each of these institutes a seminar talk was given on the activities of the NDS and on the international cooperation and information exchange in the field of neutron data. The various groups working in nuclear sciences were visited in order to see their experimental facilities, to discuss their nuclear physics research work and possible regional coordination with other groups, and to investigate which activities of the Nuclear Data Section should be intensified to become most beneficial to their scientific work. Although CINDA, CINDU, DASTAR, INDC-documents etc. were generally known and used, it was evident that the personal contacts stimulated many scientists to make more use of the services of the Nuclear Data Section. It was considered most regrettable that CINDA could no longer be distributed free of charge.

RENDA and any other request-lists to be prepared and/or distributed by the Nuclear Data Section, are considered everywhere as most important. In many laboratories, fundamental nuclear physicists do no longer receive support for their work unless they can prove that their measurements are needed directly for some applications. The Request Lists can provide this justification and are therefore an essential basis for the continuation of nuclear data measurements in many institutes. A general feeling was expressed that the Request List documents should get wide distribution and should remain free of charge. There was much interest in Request Lists for data needed in other fields of nuclear technology such as fusion, safeguards, etc., which will give them further guidance and justification for their research programme.

There was also considerable interest in an international exchange system for nuclear data other than neutron data, such as nuclear spectroscopy, charged particle and photon-reaction data. Some institutes expressed their willingness to participate in an international compilation and exchange system for nuclear spectroscopy data if such a system is to be created.

In many East European laboratories experimental groups are specialized in measuring (n,p) and (n,α) data at 2 MeV and 14 MeV. Many data of this type are not yet sufficiently well known but urgently needed in the energy range of 100 keV to a few MeV for two purposes:

(a) for stability calculations of reactor materials,

(b) for dosimetry and flux measurements with threshold detectors.

The coincidence of such data needs with the existing research activities in East European institutes makes the situation particularly favourable for the Agency to organize a regional cooperation.

The multilateral wishes for closer regional cooperation became also evident from the project which is under study at UNESCO; this project would support a regional research centre for neutron physics research to be situated at Zagreb. There were also suggestions from Hungary and Romania to organize a summer school for which some support of the Agency was requested. In particular Romania proposes a summer school on "Nuclear Data for Reactors" which could be most suitable to itensify the regional cooperation in this field.

In the course of the field trip particularly fruitful contacts were established with respect to data evaluation activities and the usage of evaluated data. The institutes at Budapest, Belgrade and Bucharest requested and received the KEDAK-file, and the UK-file as far as this has been released to the NDS; requests for the ENDF/B-file were also received from these countries. Poland and Czechoslovakia requested and received selected evaluated data sets. All of these countries have some reactor calculation projects, often severely limited by too small computers. Several times it was requested that the NDS should not only transmit files of evaluated microscopic data, but also provide sets of group cross-sections calculated from these files, because the available computer facilities are often not sophisticated enough to perform such calculations.

Larger projects exist in Hungary, Yugoslavia and Romania, where better computers (CDC and IBM) are available and direct cooperation with Karlsruhe and other West-European laboratories exists. Some activities are: in Budapest a group (Fischer et al.) is doing flux measurement in reactors using threshold-, resonance- and fission-detectors. The required cross-sections are being evaluated using experimental data retrievals provided

through the NDS. The resulting evaluated data library is made available to the NDS. The relevant unfolding computer programmes are made available to the ISPRA programme library. Another group at Budapest (Vertés) is calculating group constants (26 group Abagjan set) from evaluated data files provided through the NDS.

At Debrecen, Hungary, systematics of total elastic and total non-elastic cross-sections at 14 MeV are being evaluated (Csikai), and relevant experimental data retrievals were provided through the NDS. In Bucharest a laboratory for nuclear data was recently created within the Institute for Atomic Physics. This laboratory is just preparing its future working programme in contact with NDS, the Karlsruhe Nuclear Research Centre and other places. Particular emphasis is envisaged to be given to nuclear data evaluation for which several physicists and a few programmers will be made available.

Another group of the same institute (Petrascu et al.) finished an absolute determination of the 2200 m/s fission cross-section of Pu-239. The result (σ_o = 741. ± 7. barns), based on the Pu-239 α-decay half-life and the accurately known B-10(n,α) branching-ratio, agrees with Deruytter's result and the recommended value of the IAEA-review. The experiment was throroughly reviewed by the NDS in contact with Dr. Deruytter, whereby the author's value requires only a minor adjustment of about 0.1%.

APPENDIX K

SIXTH FOUR-CENTRE MEETING

5 - 9 October 1970

Paris

A G E N D A

1. Organization and Announcements

   a. Introductory remarks and election of chairman
   b. Consideration and adoption of agenda - Meeting organization

2. Short Reports from Centres

3. Exchange Format

   a. Review of EXFOR implementation schedule and cooperative agreement: comments, suggestions of changes or improvements of exchange mechanics.
   b. Data transmissions: computer checking programs. Correction and revision of transmitted data.
   c. Compilation aspects: problems, questions and proposals, considerations of general data scope.
   d. Dictionaries: proposed additions. Dictionary 14. Discussion and formulation of fission products and compound nucleus quantities descriptions.
   e. Specific changes to the EXFOR manual.
   f. Compiler's manual.
   g. Systematic transformation of old data into EXFOR.
   h. Exchange and formats of evaluated data.

4. Data Index

   a. CINDA publication: status and schedule
   b. What kind of data index is needed ?
   c. Production of data index: extraction from EXFOR
   d. Coordination with CINDA

5. Coordination of Four Centre Functions and Activities

   a. Delineation of responsibilities of mutual interest
   b. Unification of document distribution
   c. Exchange of data centre experience
   d. Non-neutron nuclear data
   e. Interest profile. What are the current demands ?
   f. Publicity of EXFOR

6. Conclusion

   a. Summary of meeting recommendations and actions
   b. Date and place of next meeting

APPENDIX L

CONSULTANTS MEETING ON NUCLEAR DATA,

Vienna, 14-18 December 1970

A g e n d a

I. Experimental data

1. Current experimental neutron data research in the USSR
2. Compilation activities at CJD
3. Computer facilities currently available to CJD
4. Recent EXFOR proposals
5. Experience and problems with EXFOR entries and transmission tapes
6. Status of CJD programming for EXFOR
7. Compiler's Manual EXFOR
8. Non-EANDC RENDA

II. CINDA

1. Coverage of USSR literature for CINDA
2. CINDA publication

III. Evaluated data

1. Evaluation activities
2. Evaluated data formats
3. Dissemination of evaluated data within the USSR
4. International exchange and dissemination of evaluated data
5. Recent group cross section sets developed in the USSR
6. 1971 IAEA Panel on Methods of Evaluation and adjoining Specialists Meetings
7. Documentation of experimental data used in evaluations

IV. Date and place of the next Four-Centre Meeting

V. Other nuclear data

1. Nuclear data for safeguards development
2. Nuclear data for thermo-nuclear fusion reactors
3. International Working Group for the Compilation, Evaluation and Dissemination of Nuclear Structure and Reaction Data
4. Reactor data needs outside the scope of EXFOR