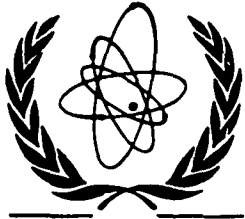


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International Atomic Energy Agency

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INTERNATIONAL NUCLEAR DATA COMMITTEE

REPORT OF THE FIFTH FOUR-CENTRE MEETING

Moscow, 17-21 November 1969

December 1969

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

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by A. Lorenz

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REPORT OF THE FIFTH FOUR-CENTRE MEETING

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Summary and Highlights

The fifth of a series of nuclear data Four-Centre* Meetings has taken place in Moscow, USSR, 17-21 November 1969. These Four-Centre Meetings, held about yearly at the site of one of the centres, serve to coordinate the international effort in the collection, compilation and dissemination of neutron data information.

The continuous expansion of the centres' neutron data libraries and the existence of different computers and data storage systems in each of the four centres, have demonstrated the need for an unambiguous and unique inter-face for the data transmission between the four centres, and for an increase of efficiency in the international dissemination of neutron data information. At the last Four-Centre Meeting, in December 1968,

- continued

* The four neutron data centres which form the basis for the international cooperation in the field of nuclear data are: the National Neutron Cross Section Center (NNCSC), Brookhaven, USA; the Neutron Data Compilation Centre (NDCC), Saclay, France; the Nuclear Data Centre (CJD), Obninsk, USSR; and the IAEA Nuclear Data Section (NDS), Vienna.

general characteristics of a unique system for the inter-centre exchange of neutron data information had been formulated. The primary objective of the present meeting had been to reach a final agreement on the details of this exchange system, including the following essential items:

- a. detailed format definitions
- b. neutron reaction classification scheme
- c. dictionaries required to identify and codify the data and auxiliary information to be exchanged between the centres.

In brief it can be stated that this meeting proceeded in an excellent spirit of cooperation and was very successful in achieving this goal and to agree on a series of steps necessary for the implementation of the exchange system by mid-1970. The acronym "EXFOR" (Exchange Format) has been adopted as name of the system. It is noteworthy to point out that this system, which makes efficient use of the existing computer facilities in the four centres, is unique and probably the first of a kind in the field of international cooperation in the nuclear energy field.

One day of the Meeting was devoted to a visit to the Institute of Physics and Energetics at Obninsk. In particular, discussions were held on problems of evaluation and of evaluated data exchange, and visits were made to the Nuclear Data Centre, and to the computer and accelerator facilities of the laboratory.

AGENDA

1. Introductory Remarks and Election of Chairman
2. Adoption of Agenda and Meeting Organization
3. Short Reports from Centres
4. Exchange Format
 - (a) Structure
 - (b) Content
 - (c) Dictionaries (except specification of data)
5. Specification of Data
 - (a) Review of existing proposals
 - (b) Correlation with CINDA quantities
 - (c) Adoption of data specification
 - (d) Compiler's manual
6. Implementation of Exchange Format
 - (a) Transmission procedures: schedule, mechanism and timing
 - (b) Correction and revision of transmitted data
 - (c) Systematic revision of old SCISRS I and equivalent data
 - (d) Four-Centre Memos for communications on Exchange Format
7. Data Index
 - (a) Nature of Index
 - (b) Automatic extraction of index
 - (c) Phasing in with CINDA
 - (d) Publication and dissemination of index and CINDA
8. Miscellaneous
 - (a) Interest Profile and standing requests
 - (b) Data for special emphasis - coordinated data reviews
 - (c) Review of Panel Report Recommendations
 - (d) Evaluated Data Libraries at each of the four centres
9. Plans for Future Cooperation
 - (a) Proposal for 1970 programmers' workshop
 - (b) Date and place of next meeting

Meeting Proceedings

1. The meeting convened on Monday, 17 November 1969, at 9:30 am. in a meeting room of the Hotel "Ukraine" in Moscow. There were present:
 - A.I. Abramov (Institute of Physics and Energetics, Obninsk)
 - V. Bell (NDCC) Head of Centre
 - A.V. Ignatiuk (CJD)
 - H.D. Lemmel (NDS)
 - H.O. Liskien (NDCC)
 - A. Lorenz (NDS)
 - S. Pearlstein (NNCSC) Head of Centre
 - V.I. Popov (CJD) Head of Centre
 - J.J. Schmidt (NDS) Head of Centre
 - S.I. Sukhoruchkin (Institute of Theoretical and Experimental Physics, Moscow)
 - Mr. Klimov (USSR State Committee on the Peaceful Utilization of Atomic Energy)
 - Mr. I. Tichonov served as interpreter for the participants from the USSR.

2. After a brief opening statement by G.A. Kornev (USSR State Committee) and an introductory statement by J.J. Schmidt (NDS), A. Lorenz (NDS) was elected chairman of the meeting. The draft agenda, as submitted to the participants prior to the meeting, was discussed and adopted.

3. Under Agenda item 3 the representatives of each of the four centres gave short progress reports. The summaries of these reports are given in Annex I.

4. Inasmuch as Agenda items 4, 5 and 6, namely "Exchange Format", "Specification of Data", and "Implementation of Exchange Format", constituted the main topic of this meeting on which agreement had to be reached, it was decided from the beginning to concentrate on these items and consider items 7 and 8 of the agenda only if enough time remained.

5. In the course of the year preceding this meeting, a number of proposals and counter proposals which touched on various aspects of the Exchange Format, had been written and distributed among the four centres. A list of these background documents, which had been prepared by the NDS prior to the meeting, is given in Annex II. The chairman then suggested that the main background documents to be used as a basis for discussion of agenda items 4 and 5 be:

Document No. 1: "Centre-to-Centre Transmission Format Manual" by P.M. Attree (NDS), as amended 17 October 1969

Document No.10: "Proposal on Content of centre-to-centre Transmission Format" submitted by NNCSC, July 1969

Document No.20: "Dictionaries for use with the Exchange Format" by P.M. Attree (NDS), 11 November 1969.

Other papers in the list of background documents were subsequently introduced to complement and clarify the contents of documents nos 1, 10 and 20.

6. The participants then proceeded with a point by point review of document no. 1, and subsequently of document no. 20, introducing changes, corrections, additions and deletions where needed. This task, which resulted in the commonly acceptable and comprehensive descriptions of the structure and content of the Exchange Format and of the Data Specification (Dictionaries), took most of the time allowed for the meeting.
7. It was then agreed by the participants that the two reviewed documents, viz. the "Centre-to-Centre Transmission Format Manual" (1) and "Dictionaries for use with the Exchange Format" (20), would be revised by the NDS, taking the decisions reached at this meeting into account, and distributed to the other centres for their approval and comments not later than 16 January 1970.
8. As a consequence of this review, which covered Agenda items 4 and 5, and of the considerations of Agenda item 6, "Implementation of the Exchange Format", the representatives of the four centres reached

a number of conclusions and agreed on a specific schedule for the implementation of the Exchange Format for routine transmission of nuclear data. The "Conclusions and Recommendations on the Exchange Format" constitutes Annex III to this report. A timetable for the implementation of the Exchange Format is given in Annex IV.

9. An inherent part of the general subject of the dictionaries for the use with the Exchange Format (i.e. specification of data) was the formulation of a practical and self-consistent scheme for neutron reaction classification. Basing their deliberations on the numerous suggestions proposed in the course of the last year, the centre representatives concurred on a practicable classification scheme and developed it within the framework of the ISO-QUANT formalism (a coding formula used in the Exchange Format to uniquely identify a specific physical aspect of a neutron induced reaction on a given isotope). A detailed description of this classification scheme will be included in the "Exchange Format Manual", to be distributed by the NDS by 16 January 1970.
10. Brief consideration was given to Agenda item 6c, viz. the "Systematic revision of old SCISRS I and equivalent data". A plan was proposed by the NNCSC, whereby the four centres would share the task of revising the old SCISRS I data, held in the NNCSC files, and of transforming them into the EXFOR format. However, because of the considerable task at each of the four centres to adapt to the agreed upon EXFOR system, it was decided by the participants to postpone this agenda item until the next Four-Centre Meeting.
11. With regard to Agenda item 7, the representatives of the four data centres agreed on the desirability of an international data index but concluded that it was premature to formulate specific recommendations at this point; it was felt that this would be a timely topic at the time of the next Four-Centre Meeting.

Note was taken of the preliminary report by M.H. Kalos, who served as a short-term consultant to the NDS prior to this Four-Centre Meeting, with regard to a unified data and bibliographic index (see Annex 2, document 25).

12. The topics listed under Agenda item 8, "Miscellaneous", were discussed briefly during the remaining time allowed for the meeting:
 - The NDS mentioned the initial effort that the centre in Vienna has started with regard to the compilation of an Interest Profile in its service area. A preliminary listing of this file was distributed to the participants.
 - The topic of "Data for special emphasis - coordinated data reviews", was introduced by the NDS. As an illustration of this effort a report on the status of the U²³⁸ Capture Cross Section, written by V. Konshin of the NDS, was distributed to the participants.
 - Because of the shortage of time, the Neutron Data Compilation Panel Recommendations were not reviewed in the course of the meeting. The NDS distributed to the participants a copy of the Findings of this panel, published by the IAEA as Technical Report No. 100. However, it should be noted that the main topic of the meeting fulfilled some of the most important recommendations of that Panel.
 - The topic of "Evaluated Data Libraries at each of the Four Centres" was not discussed.

13. In addition to the topics listed on the Agenda, a few additional items were introduced for consideration:
 - It was agreed that the four centres will present a joint paper on the status of the international effort in neutron data compilation and dissemination at the forthcoming IAEA Conference on Nuclear Data, which will be held at Helsinki, 15-19 June 1970. Each of the four centres will submit contributions to this joint paper in the form of a progress report of their own centres to

the NDS not later than 1 March 1970. A draft of this joint paper will be circulated by the NDS to the other centres by the end of March 1970.

- It was agreed that each centre should provide to each of the Helsinki Conference invited speakers the numerical material which they would require for their presentation. This neutron data information would be provided on request and forwarded through the established data exchange channels.
 - It was also recommended that the four data centres strive to collect the neutron data presented by the participants of the Helsinki Conference and enter them into their data files.
14. One day of the Four-Centre Meeting, Wednesday, 19 November, was devoted to a visit to the Institute of Physics and Energetics (FEI) at Obninsk. During this visit the participants had a chance to visit the USSR Nuclear Data Centre (CJD), located at that institute, and discuss problems of neutron data information exchange. In addition to V.I. Popov and A.V. Ignatiuk, members of the CJD centre who participated in the Four-Centre Meeting, the visitors were introduced to the remainder of the centre staff, namely: Mr. D.A. Kardashev, Mr. V.V. Surgutanov, Mrs. L.S. Tarasko and Miss Surkova. Following this visit the staff of the Institute organized a seminar on data evaluation which gave an opportunity to J.J. Schmidt (NDS) to outline the general philosophy of the basis of Western evaluation work, and to S. Pearlstein (NNCSC) and M.W. Nikolaev (FEI) to describe the neutron data evaluation effort in their respective countries. The last part of the day was devoted to a visit of the computer and accelerator facilities at that Institute.
15. As a final recommendation, the meeting participants agreed that:
- A Programmers' Workshop be held at the IAEA Headquarters in Vienna during the week of either 11 or 18 May 1970. The timing of this technical meeting should be such as to allow a most

effective coordination of the programming effort for the Exchange Format and the schedule for its implementation.

- The next Four-Centre Meeting be held during the first week of October 1970, that is 5-9 October 1970, at the site of the Neutron Data Compilation Centre (NDCC) at Saclay, France.

ANNEX I/A

REPORT FROM THE NATIONAL NEUTRON CROSS SECTION CENTER
AT BROOKHAVEN NATIONAL LABORATORY, USA
TO THE INTERNATIONAL ATOMIC ENERGY AGENCY

4-Centre Meeting

Moscow, U.S.S.R.

November 17, 1969

Organization

A recent photograph of the NNCSC was distributed to each of the other Centers. An organization chart showing the break-up of the NNCSC into cross section compilation, evaluation, theory, and computer application was also distributed.

NNCSC Computer

A PDP-10 computer, manufactured by the Digital Equipment Corporation, was recently installed in a temporary location at the NNCSC. Its fast memory is 40K - 36-bit words. Two 7-track tape units are used for input and output of data. Permission to obtain a 9-track tape unit has been requested. A 300-per-minute card reader, a 1000-lines-per-minute printer, and a 30-inch CALCOMP plotter are included in the system. Two additional 7-track tape units will be replaced by discs during 1970.

An interactive display unit has been requested from the USAEC.

Compilation Activities

The status of the experimental data files and experience with the author-proof system was reviewed. Present computer experiments with SCISRS-II and the BNL proposed exchange format were described. The use of the codes FIXIT and TRANS were described and examples shown. The dictionaries presently in use by BNL were distributed.

Evaluation Activities

A preliminary report of 2000 meter-per-second cross sections (to be published in Nuclear Data) was distributed. Further discussion of this topic was reserved for the Obninsk visit when Soviet evaluators would be present.

Future NNCSC Plans

Plans for the automated publication of BNL 400, "Angular Distributions in Neutron-Induced Reactions," were reviewed. The contents of a short NNCSC Newsletter to describe recent entries to the experimental and evaluated data libraries were shown in examples that were distributed.

CCDN PROGRESS REPORT

I. Experimental data

A major development during the past year at CCDN has been the introduction of the NEUDADA data storage and retrieval system to enable fuller and more rapid use to be made of the SCISRS I file. This system has been developed to make the fullest use of the direct access storage features of the 360/30 computer. At present it is available for use with the current NNCSC/CCDN data library, which also incorporates the most recent CCDN compilations prepared, as far as possible to the information content level of SCISRS II. Dissemination of data on request from this library was started in January 1969, and an extended retrieval facility* has been in use since July.

A supporting system of programmes was also developed for preparing an edited version of the internal data file index for publication as a CCDN Newsletter. This work involved the checking and correcting of the SCISRS I reference abbreviation and principal author for each entry in the file, and is required in order to know the precise contents of the data library and to make possible the subsequent automatic correlation of this library with CIND A. In particular, Newsletter No. 8 was distributed in April 1969 giving details of the library's contents on 15th March 1969, and a revised edition of this Newsletter will be published in November 1969 as Newsletter No. 11 giving details of the contents of the data library on 15th October 1969. A consultant is now engaged in making the correlation between this index and CINDA.

In addition, a modified version of the ECSIL bibliographic system called CREED (Compilation of REferences to Experimental Data) has been developed for use as a bookkeeping system for the CCDN data compilation activity.

In conjunction with this system development work, there have been discussions among physicists (both experimentalists and evaluators) on extending and defining the amount of supporting information which should be compiled for each data set and also on the development of a new reaction classification scheme. It is intended that agreement on these developments will be reached in the present four-centre meeting.

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* Retrievals can be made on any combination of the following parameter defining data sets: Z, A, reaction, status, method, standard, laboratory, source, year, reference abbreviation and energy range.

In addition, in order to further the exchange of compiled experimental data between the four data centres, the CCDN has placed a contract for the development of computer programmes for the translation of data between the NEUDADA transmission format and the four-centre International Exchange Format. It is hoped that data exchanged on the basis of this exchange format will be initiated in 1970.

II. CINDA

In March 1969 a supplement to CINDA 68 was distributed, while the full 1969 print-out (CINDA 69) was distributed in July. This print-out included all entries received up to the beginning of May 1969. The first supplement to CINDA 69 is being prepared in the United States to a cut-off data for entries of 20th November 1969. A second supplement to CINDA 69 will be published in the summer of 1970 and replace the publication of CINDA 70.

Most of the past year's work on CINDA at CCDN has been devoted to finding and filling gaps in the coverage before about 1962 and to bringing the last remaining European entries in the old format up to current standards. This has been in preparation for a second attempt during the coming year to consolidate multiple entries for the same work. Back coverage will be extended further, both by systematically checking main journals and by reference to private card files held by K. Parker and J. Story.

Although other commitments have prevented any changes to the CINDA programmes, much of the necessary ground work for its automatic checking against the data file has been done. As an interim measure, CINDA 69 contained a list of all references from which data had been stored in the CCDN file at the time of the Centre's Newsletter No. 8. Recently lists of CINDA second cards, which do not comply with the agreed format for secondary references, have been distributed to other data centres for correction and subsequent re-entry.

CCDN proposals for the reprogramming of CINDA have been submitted to the other participating centres, and it is intended to define the physical and operational parts of a new CINDA system before the end of 1969.

III. Evaluated data

An information sheet giving details of the evaluated data files which are available at CCDN for distribution in participating countries was circulated at the end of 1968. Although the distribution list for this document was quite small, several copies were sent to each recipient, who was asked to arrange circulation and distribution within individual laboratories of participating countries.

The CCDN received the KEDAK library in card image format in March 1969, and distribution has now started.

An updated version of the compilation of evaluations of neutron cross-sections was published in May 1969 as CCDN Newsletter No. 9.

A system of programmes has been developed for the storage on disc of the United Kingdom Nuclear Data Library and for subsequent retrieval from this file by nuclide or by process. The system also includes options for plotting cross-section data and for the superposition of evaluated cross-section data on plots of the available experimental data retrieved from the data library.

5th November 1969

ANNEX I/C

Report from the IAEA Nuclear Data Section

November 1969

In consideration of the new staff in some of the data centres this report from the IAEA Nuclear Data Section consists of a review of its data centre activities within the framework of its overall responsibilities.

The NDS staff consists at the present time of 17 people, 11 professionals (9 physicists and 2 programmers), 3 computer support staff and 3 secretaries. The general aspects of the NDS activities can be classified into three categories:

- International Nuclear Data Committee responsibilities
- Peripheral activities
- Data Centre activities.

A. INDC Responsibilities

These consist of:

- Organizing and acting as scientific secretariat to the yearly INDC meetings.
- Internal liaison with the IAEA Secretariat
- Distribution of INDC documents
- Maintaining contact with the INDC Liaison Officers
- Maintaining and publishing a current list of nuclear data correspondents.

B. Peripheral Activities

This category of activities falls within the sphere of responsibilities of the NDS as an integral part of the IAEA. The major ones among these activities are:

- Organization of Conferences and Panel meetings (e.g. Paris and Helsinki Conferences, Brussels Standards panel)
- Development of ways to provide targets and foils for developing countries
- Establishment of a non-EANDC "RENDA" Request List.

The activities listed in parts A and B above require approximately 3 to 4 man-years. The remaining man-years are devoted to the data centre responsibilities.

C. Data Centre Activities

The primary responsibility of the centre is the systematic coverage of the NDS service area. For efficiency this service area has been divided into four geographical areas, each of which is covered by two physicists. The sharing of this responsibility is as follows:

- Latin America: T. Byer and F. Manero
- Asia and Australia: A. Lorenz and H.I. Bak
- Eastern Europe: H.D. Lemmel and V. Konshin
- Middle East and Africa: L. Hjärne and A. Koster

The normal procedure by which each of these areas is covered consists of a number of sequential steps:

- Scanning of reports and journals
- Entry of data into the system or writing author for data
- Simultaneous entry into the CINDU index
- Cross check with CINDA, which results in either an updating of CINDA or in a new CINDA entry
- Processing and computer input of information
- Proof copies in listing form sent to authors.

Another source of data arises from direct contact with scientists in the NDS area.

- Some scientists, by now familiar with the NDS data centre services, send their data on a voluntary basis.
- Meetings held at the IAEA Headquarters give the opportunity to scientists in the NDS area to visit the centre; at the same time the data centre personnel participate at these meetings.
- Missions of the NDS staff to the laboratories and universities within the NDS service area. Two such field trips have been conducted (Asia and Australia in 1968, and Latin America in 1969) and the next one is planned to the Eastern European countries during the coming year.

In order to improve the coverage and service of its service area, and to coordinate the data centre activities with its other activities, the NDS has started the compilation of a "users profile" (a document illustrating this effort was distributed at the meeting).

In addition to its data compilation function, the NDS data centre actively participates in the international CINDA effort. In this context the NDS carries on a semi-independent CINDA activity which consists of the following:

- Control and transfer of input from external CINDA readers (primarily the USSR) to the CINDA collection centre.
- CINDA input resulting from the data coverage at the centre.
- Independent CINDA literature scanning (which provides a double check and feed-back to the data compilation effort).
- Planning, coordination and publication of the CINDA index in cooperation with the other CINDA centres.

Another data centre activity which has been started within this past year is the review of data of particular interest for the benefit of the NDS customers. One such review, completed before this meeting, is V. Konshin's review of the U^{238} capture cross section (published as INDC(NDU)-14/N). Other reviews, of similar scope, have been initiated at the NDS.

In support of all of these activities, the NDS maintains an active systems planning and programming effort. In particular, considerable effort has been devoted to the current development of the Exchange Format system, both in cooperation with the staff of the other centres, as well as within the scope of the development of its own data storage and retrieval system.

ON THE ACTIVITY OF THE NUCLEAR DATA CENTRE
OF THE STATE COMMITTEE ON THE ATOMIC ENERGY UTILIZATION

A.I. Abramov, L.N. Usachev

Since the 4-Centre meeting in Vienna in December 1968 our Centre has continued its activities according to the program described in Dr. Zolotukhin's paper at the February 1969 Panel on compilation which was held at the Brookhaven National Laboratory. The main efforts of the Centre staff have been directed toward the development of the programs for translating information from IBM tapes onto the M-220 computer tapes and vice versa, as well as to participate in the work on the exchange format which is to be specifically considered at this meeting. It should be noted that the exchange format is of particular importance to our Centre, as it is supposed to be used for our internal needs, at least at the beginning of our work.

The 7th issue of the collection of abstracts "Nuclear Physics Research in the USSR" was published in spring of 1969. At the present time the 8th issue of the Collection of Abstracts and the 6th Bulletin are being prepared for publication. We have also continued the work on our Centre Data Index which is similar to CINDU. In the field of CINDA, during this year 33 cards containing 624 entries had been filled in and sent to Vienna.

In exchange to information of the latest USSR measurement results and evaluations of neutron data which we have sent to the IAEA, our Centre has received a considerable amount of information on magnetic tapes which have been used for the development of the tape translation system mentioned above.

In order to improve the guidance of all the activities on the collection, handling and dissemination of neutron data information, the Nuclear Data Committee of the State Committee on the Atomic Energy Utilization was formed, it replaces the previously acting Council of the Nuclear Data Information Centre. The director of the Institute of Physics and Power Engineering (FEI) in Obninsk, Professor V.A. Kuznetsov, was appointed chairman of this Committee. The committee members are physicists from different institutes of our country in which neutron data investigations are carried out; among them are the academician of the Academy of Sciences of the BSSR Professor A.K. Krasin, the academician of the Academy of Sciences of the UkSSr Professor M.V. Pasechnik, Professor F.L. Shapiro (JINR, Dubna), as well as the participants of this meeting, Dr. V.I. Popov (FEI, Obninsk), Dr. S.I. Sukhoruchkin (ITEF), Mr. Yu.G. Klimov (State Committee on Atomic Energy Utilization) and the authors of the present report.

At the Committee's meetings, which take place several times a year, the following questions are considered: the state of the nuclear data compilation and evaluation, the needs for nuclear data for practical applications, the reports of the Nuclear Data Centre on its current activities, as well as the review of the current investigations of the most important nuclear constants. The proposals and recommendations of the Committee are taken into consideration when planning scientific research in different institutes of our country.

All of the practical work on nuclear data collection and dissemination is performed as before by the Nuclear Data Centre of the State Committee on the Atomic Energy Utilization located at the Institute of Physics and Power Engineering (FEI) in Obninsk. The staff of the Centre, headed by Dr. V.I. Popov, consists of several people working permanently; in addition a number of FEI employees take part in helping with various tasks of the Centre. The permanent working staff of the Centre is involved in the development of computer programs, in CINDA activity, in the preparation for publication of the Centre's

Bulletin and collection of abstracts, as well as in carrying out of routine tasks.

The main effort in the field of nuclear data evaluation and in the analysis of nuclear data requirements is carried out in different laboratories of FEI and at other Scientific Institutes. However, the organization of the evaluation effort demands careful attention with the aim of continuous improvement.

We plan to increase the Centre staff to reinforce the above mentioned trends existing now in the Centre. Two new groups are to be organized. One of them will continue the work on neutron constants evaluation started by V.I. Popov, and the other one will ensure mathematical service of the Centre.

At present our Centre uses for its needs the M-220 computer. As it is known, the tapes for this computer are incompatible with the IBM tapes which are used in many countries. This situation creates considerable difficulties in the exchange of information with the other data centres. Already in the course of this year we hope to receive two tape units: one Plessey 5500 and one IDR type 703 B designed for operation with 7-track 1/2-inch tapes.

Two coordinating groups, consisting of specialists from different scientific institutes, have been formed in order to effect an efficient working relationship between our Centre and these institutes, and to coordinate the work being performed at these institutes with that of the Centre. One of these groups, headed by Dr. V.G. Zolotukhin, will be engaged in defining and making a systematic collection of the requirements in the nuclear data field, and in constructing multi-group systems of neutron constants. The other group headed by Dr. V.I. Mostovoy, will deal with the coordination of the nuclear data measurements and with the problems of experimental data compilation and evaluation. The suggestions made by these groups are to be reviewed and taken into consideration at the meetings of the Nuclear Data Committee.

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ANNEX II

Background Documents to the Discussions on the Exchange Format

1. "Neutron Data Inter-Centre Exchange Format"
Memo from P.M. Attree to Four-Centre meeting participants dated 9 December 1968.
Later distributed as "Centre-to-Centre transmission Format Manual" and amended 17 October 1969. Distributed by P.M. Attree
2. "Dictionaries for use with the Exchange Format"
Memo from P.M. Attree to 4 Centres, dated February 1969
(Replaced by item 20)
3. "The specification and characterization of Neutron Data"
Paper by M. Goldberg presented at Compilation Panel, dated February 1969
4. "Index Quantities" (NDU Memo 60) to Goldstein and Goldberg from L. Hjärne, dated 15 April 1969
5. "Quantities", Draft proposal by M. Goldberg - dated 3 April 1969 (NDU Memo 61) (Superseded by item 9)
6. "Meeting on Quantities at Columbia U. 29 May 69" from L. Hjärne (NDU Memo 68) (Superseded by item 9)
7. "Iso-Quant Field Proposal", Memo from Cullen to Goldberg (NDU Memo 69) dated 19 May 69
8. "Dictionaries" (NDU Memo 70) from L. Hjärne to internal NDU distribution, contains NNCSC comments dated 26 June 1969
9. "Definitions for Neutron Data Specification", submitted by NNCSC July 69 (NDU Memo 73) (Supersedes items 5 and 6)
10. "Proposal on content of centre-to-centre Transmission Format" submitted by NNCSC July 69 (NDU Memo 74)
11. Letter Hjärne/Goldberg, dated 21 August 69, as reply to item 10
12. "Letter re quantities" from Lemmel to Goldberg, dated 4 September 69 (NDU Memo 78)
13. Memorandum from Cullen to Goldberg commenting on item 12, dated 22 September 69
14. Letter Goldberg/Lemmel (re: quantities) in reply to item 12, dated 2 October 69 (NDU Memo 84)
15. Letter Goldberg/Hjärne in reply to item 11, dated 7 October 69
16. "Quantity Codes and Definitions" by H.D. Lemmel, dated 10 October 69 (This supersedes "Quantity Codes, Draft Proposal", dated 28 March 1969 = NDU Memo 58)

- continued

17. Letter Lemmel/Goldberg (re: quantities) in reply to item 14 (NDU Memo 86) dated 6 November 69
18. "Proposal for a unified quantity format for data, common data, normalization values, etc. ..." by H.D. Lemmel, dated 7 Nov 69 (NDU Memo 89)
19. "Proposal on the Information Content of Inter-Centre Data Transmission", by Leif Hjärne, dated 7 November 1969 (NDU Memo 85)
20. "Dictionaries for use with the Exchange Format" by P.M. Attree as of 11 November 1969 (replaces item 2)
21. Letter Goldberg/Hjärne dated 2 October 1969, in reply to item 16 and letter from Hjärne
22. "Two- and more-dimensional tables" (NDU Memo 79) by Lemmel and Hjärne dated 19 September 1969
23. "Two- and more-dimensional tables" (NDU Memo 83) by P.M. Attree dated 3 November 1969
24. "Plans for a unified data and bibliographic index" (NDU Memo 88) by H.D. Lemmel, dated 12 November 1969
25. "Recommendation by M. Kalos on unified data and bibliographic index" (Note: preliminary version)
26. "Status" by H.D. Lemmel
27. "Quantities Compromise", H.D. Lemmel
28. "Sample of transmission listing", P.M. Attree
29. "The SCISRS II Cross section classification", N. Tubbs (NDCC)
30. (\approx 1) D.E. Cullen, W. Busarello, "BNL programmer's guide to the Centre-to-Centre Transmission Format for Experimental Information", 1 May 1969. Revised August 1, 1969; 2nd revision October 1, 1969.

ANNEX III

CONCLUSIONS AND RECOMMENDATIONS ON THE EXCHANGE FORMAT

1. Exchange Format

a) Structure and Content

Document No. 1 (exclusive of the dictionary section) as revised by the meeting participants shall serve as the basis and guide for data transmission between the four centres. This document, appropriately revised, will be distributed by the NDS by 16 January 1960.

b) Changes and Alterations

It was agreed that no changes in the structure of the Exchange Format will be allowed without Four-Centre agreement.

c) Name of the System

It was agreed to refer to this system as the Exchange Format for inter-centre transmission of nuclear data, and to adopt the acronym EXFOR for reference to the over-all system.

2. Data Specification Dictionaries

a) Content

- (1) Document 20, as revised by the meeting participants shall serve as the basis and guide for the description and coding of nuclear data information into the Exchange Format. This document, including those revisions and additions which will be received by the NDS before 1 January 1970, will be distributed by the NDS to the other four centres not later than 16 January 1970.
- (2) Final comments on the content of the dictionaries should be sent by the other centres to NDS not later than 23 January 1970.
- (3) If this schedule is adhered to, it is anticipated that the initial correct version of the dictionaries will have been received by the four centres by 1 February 1970.

b) Routine Transmission of Dictionaries

- (1) After the initial transmittal of the revised dictionaries by the NDS to the other centres, that is, as of 1 February 1970, the NDS will continue to transmit a full set of updated dictionaries to the other three centres every three months.
- (2) The keywords (DICTION, ENDDICTION and NODICTION) will be used by the NDS for transmission of updated dictionaries whether they are part of a data transmission or not. Dictionaries may also be transmitted between centres for comparison purposes.
- (3) In the case of transmission of Dictionaries and Data in the Exchange Format to a requestor, care must be taken that the Dictionaries are the latest and therefore inclusive of all terms used in the data transmitted.

c) Updating of Dictionaries

- (1) To prevent duplications and conflicts, the NDS will have the responsibility to coordinate the updating of the dictionaries. New dictionary entries, proposed by any of the centres, will be sent together with mnemonic terms and their definitions to the NDS by cable or air mail. Within three days of their receipt, the NDS shall transmit the approved dictionary entries to all centres simultaneously, in the agreed dictionary format to permit easy computer handling. The NDS will be given some latitude in reformulating the definition, but must not change the meaning without the approval of the originating Centre. It will be the responsibility of each Centre to update its own sets of Dictionaries.
- (2) Changes of the Dictionaries which require changes to data already transmitted cannot be implemented without specific Four-Centre approval.

3. Implementation of Exchange Format**a) Implementation Schedule**

- (1) It was agreed that a realistic date to start using the Exchange Format for the formal transmission of data tapes would be 1 July 1970.

- (2) It was also agreed that the adopted EXFOR system, with its conventions, is applicable to new data only, where new is defined as data received by the centres at the time of, or after, formal transmission of data is initiated. This, however, should not preclude any one centre's option to include or transform "old" data into the Exchange Format at their own discretion.
- (3) It was suggested that a formal agreement, which would specify the initiation date of data transmission in the Exchange Format, as well as the mechanism by which the Exchange Format can be changed, should be signed by representatives of the four centres in the course of the month of June (possibly at the Helsinki Conference). In this regard the NDS will take the responsibility to prepare this document, and circulate a draft of this document to the other four centres not later than 1 June 1970.
- (4) A timetable for the implementation of EXFOR is given in Annex IV.

b) Scope of transmitted data

- (1) It was agreed that the scope of routinely transmitted data (and therefore of the minimum scope of data compiled by any one of the four centres) will be restricted to the reaction types considered during this meeting and included in the "Process/Parameter" dictionary.
- (2) It was also agreed, however, that this restriction did not preclude the use of the transmission format for a wider scope of data at any one of the four centres, and that an expansion of the scope could be presented for adoption at one of the subsequent Four-Centre meetings.

c) Routine transmission of data

- (1) It is anticipated that the exchange of transmission tapes on a routine basis (i.e. after 1 July 1970) will take place at maximum intervals of three months, with the possibility of exchanging interim timely data at more frequent intervals. A stricter schedule, if deemed necessary, could be agreed upon at the time of the next Four-Centre meeting.

d) Correction and Revision of Transmitted Data

- (1) Other than an agreement to re-transmit a complete work in the event of partial correction or revision, no specific recommendation was made at this time. It was felt that a specific procedure to correct or revise transmitted data could be considered after the centres had gained working experience with the Exchange Format, and should be agreed upon at the next Four-Centre meeting.
- (2) Other than an agreement to delete a data set from the files only with the expressed approval of the author, no criteria to reassign accession numbers or to delete data sets from the files under other circumstances, have been agreed upon at this time.
- (3) It was suggested that every centre should formulate proposals for the delete criteria and accession number reassignments in the course of the next few months, taking into account pertinent recommendations by data committees.

4. Trial Exchange Format Transmission

- (1) It was proposed that an experimental transmission of data be initiated prior to the formal implementation of the Exchange Format and after the revised version of the dictionaries had been distributed. A tentative date of 28 February 1970 was set for the initiation of this trial exchange.
- (2) It was agreed that this trial transmission tape should contain one common set of data in addition to three or more other representative sets. The common data set to be prepared by each of the four centres was agreed to be: Nuc.Phys. A107 612 1/68 (Differential Inelastic Scattering on Gold, by Barnard et al.).
- (3) Each centre is to send three tapes and three listings, one of each to each of the other centres (the information on tape will have the following specifications: 80 character records, in unblocked BCD, at 556 BPI, on 7 track tapes).

- (4) In order to investigate the efficiency of tape transmissions to the Soviet Union, both NDCC and NNCSC will send two tapes to the CJD, one to be sent via the NDS (Vienna) and the other directly to the CJD via air mail.
- (5) It is expected that the transmitted tapes will be at each of the other centres by 15 April 1970. This schedule should allow one month for the analysis of the results before the "Programmers' Workshop" scheduled for mid-May 1970.

5. Compiler's Manual

It was agreed by the participants that an Exchange Format Compiler's Manual will be indispensable. During the discussions, it was pointed out that documents 16 and 19 (see Annex II), as well as documents 1 and 20, could serve as a basis for such a manual. The NDS took it upon itself to formulate an initial draft of this manual by April 1970, and attempt to arrive at a final draft by the next Four-Centre Meeting.

6. Four Centre Communication on the Exchange Format

It was agreed that documented communication between the four centres will be necessary to allow for the proper distribution and referencing of all documentation on the Exchange Format.

Two forms of documents have been agreed upon:

- a) Four-Centre Memos for the communication of proposals, programming details and other general considerations which touch upon the over-all aspect of the Exchange Format. This series of memoranda will be numbered chronologically by each centre, where each identifying number will be preceded by the identification number of the originating data-centre (i.e. 1 for NNCSC, 2 for NDCC, 3 for NDS, and 4 for CJD).
- b) Exchange Format Memos for the communication of dictionaries updating and for the transmittal of Compiler Manual pages. This series of memoranda will be issued by the NDS only, to each of the other 3 centres.

ANNEX IV

Timetable for EXFOR Implementation

1 January 1970	Last day NDS will acknowledge revisions and additions for the EXFOR Manual and Dictionaries
16 January 1970	Distribution of revised EXFOR Manual and Dictionaries by NDS to other centres
23 January 1970	Deadline for other centres to send final revisions and additions for the EXFOR Dictionaries
1 February 1970	NDS distributes final EXFOR Dictionaries Start of regular (every 3 months) Dictionary Transmissions
28 February 1970	All centres send out trial Exchange Format transmission tapes and listings
15 April 1970	Latest date at which trial EXFOR transmission will have reached all centres
30 April 1970	NDS sends out initial draft of "Compiler's Manual" to other centres
mid-May 1970	"Programmer's Workshop" (IAEA Headquarters, Vienna)
1 June 1970	NDS sends out draft of formal agreement for EXFOR implementation
mid-June 1970	Signing of formal agreement for EXFOR implementation
1 July 1970	Tentative date to start routine transmission of data using EXFOR
5-9 October 1970	Next Four-Centre Meeting (NDCC, Saclay)