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INDC INTERNATIONAL NUCLEAR DATA COMMITTEE

IAEA Advisory Group Meeting on Nuclear Structure and Decay Data

Oak Ridge National Laboratory
14-18 November 1977

SUMMARY REPORT

Edited by A. Lorenz
Nuclear Data Section
International Atomic Energy Agency

March 1978

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Abstract

The IAEA Nuclear Data Section convened this Advsiory Group Meeting on Nuclear Structure and Decay Data at the Oak Ridge National Laboratory, USA, from 14-18 November 1977. The meeting was attended by 19 representatives from 9 countries and 1 international organization.

The objective of the meeting was the consolidation of the international network of centres and groups concerned with the compilation and evaluation of nuclear structure and decay data. The specific task of the network at this meeting was the organization of the international cooperative effort with the aim to achieve a continuous and complete evaluation of all isotope mass chains on a four year cycle.

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8. Compilation and Processing of Information on Nuclear Structure and Nuclear Reactions at the Data Centre of the Leningrad Nuclear Physics Institute (LIYaF) of the USSR Academy of Sciences, I.A. Kondurov, Yu.V. Sergeenkov. (AG-105/7)

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DEFINITION OF TERMS

Nuclear Structure Data: numerical values of nuclear level structure and decay parameters and associated atomic parameters of pertinence to nuclear techniques and methods.

Tabulation: systematic collection and transcription of numerical information without critical selection or manipulation.

Compilation: systematic collection and transcription of information on a given subject with collation and re-organization for optimal presentation to the users.

Evaluation: critical appraisal of all available information compiled on a given subject and derivation of consistent best or preferred values with their uncertainties.

Mass-chain (vertical): pertaining to properties of nuclides with a given mass number.

Selected (horizontal): pertaining to a particular nuclear property or properties for a range of nuclides.

List of Abbreviations

CAJaD	Centre for Data on the Structure of the Atomic Nucleus and Nuclear Reactions of the USSR State Committee on the Utilization of Atomic Energy, located at the Kurchatov Institute in Moscow.
CBNM	Central Bureau for Nuclear Measurements, located at Geel, Belgium.
CODEN	International code for the abbreviation of periodical titles used by ASTM, INIS and Chemical Abstracts.
CPND	Charged Particle Nuclear Data
EBCDIC	Extended binary-coded decimal interchange code.
ENSDF	Computer-based Evaluated Nuclear Structure Data File developed by US/NDP.
EXFOR	Exchange Format, internationally used format for the exchange of experimental nuclear reaction data.
IAEA/NDS	Nuclear Data Section of the International Atomic Energy Agency, also NDS.
INDC	International Nuclear Data Committee.
INIS	International Nuclear Information System, operated by the IAEA, to replace Nuclear Science Abstracts.
KACHAPAG	Karlsruhe Charged Particle Group.
LIYaF	Leningrad Institut Yadernoy Fiziki: Data Centre of the Leningrad Nuclear Physics Institute of the USSR Academy of Sciences.
NSDD	NSD data = Nuclear Structure and Decay Data.
US/BNL	US National Neutron Cross Section Center, located at the Brookhaven National Laboratory.
US/NDP	Nuclear Data Project located at the Oak Ridge National Laboratory.
ZAED	Zentralstelle fuer Atomkernenergie-Dokumentation: Nuclear documentation and information centre for the Federal Republic of Germany.

Foreword

This is the third of a series of meetings of the international nuclear structure and decay data (NSDD) network concerned with the continuous evaluation of mass-chain nuclear data. The evaluated mass-chain data resulting from this concerted international effort are published in Nuclear Physics A and the Nuclear Data Sheets, and comprise the currently recommended "best values" of all nuclear structure and decay data. The meetings of this network of data centres and groups, held approximately every two years, are sponsored and organized by the IAEA Nuclear Data Section. The international NSDD network has evolved from the long-standing cooperation between the US effort, centred at the Oak Ridge National Laboratory and coordinated by the National Nuclear Data Center at the Brookhaven National Laboratory, and the effort at the Rijksuniversiteit at Utrecht in the Netherlands. All members of the international NSDD network are referred to in the text of this report by their identification code agreed upon at the May 1976 NSDD meeting. A current list of these centres, together with their codes and addresses, is given in Appendix 28.

This meeting of the international NSDD network was preceded by a full week workshop divided into a "new compiler orientation" session for new evaluators, and an "A-chain mini-review" session for the benefit of those who were in the process of completing their first mass chain evaluation. This workshop, which was sponsored by the Oak Ridge Nuclear Data Project, was found to be extremely useful, and contributed considerably to the efficient progress at the meeting of the international NSDD network which followed it.

I. SUMMARY OF THE MEETING

A. Introduction

The third Advisory Group Meeting on Nuclear Structure and Decay Data (NSDD) was convened by the IAEA Nuclear Data Section at the Oak Ridge National Laboratory, USA, from 14-18 November 1977. The meeting was attended by 19 scientists from 9 Member States and 1 international organization, representing centres and groups concerned with the compilation, evaluation and dissemination of nuclear structure and decay (NSD) data. The list of participants is given in Appendix 1. The meeting was hosted by the US Nuclear Data Project, and was chaired by Dr. S. Pearlstein, head of the US National Nuclear Data Center.

B. Objectives

The principal objective of this meeting was the consolidation of the international network of centres and groups concerned with the evaluation of NSD data so as to achieve a continuous and complete evaluation and publication of all mass chains on a four year cycle.

In particular, the meeting aimed at improving the channels of communications between the members of the NSDD network, extending the usefulness of the bibliographic (Recent References) and numeric (ENSDF) data systems used by the network, agreeing on the distribution of responsibilities and on guidelines for the systematic evaluation of mass-chain NSD data, and approving NSDD evaluation standards and procedures for the refereed publication of evaluated NSD data.

The Adopted Agenda is given in Appendix 2, and the list of papers presented to the meeting by the participants is given in Appendix 3.

C. Conclusions and Recommendations

While a more detailed account of the meeting proceedings is given in Part II of this report, the main achievements are summarized as conclusions and recommendations and listed below. The Actions which resulted from this meeting are listed in Appendix 4.

1. The meeting reviewed the development of the international NSDD network since its last meeting in May 1976, and confirmed the conclusions and recommendations reached at that meeting.

2. The meeting reviewed the ongoing horizontal NSDD compilations and evaluations, recognized the usefulness of the three existing compilations of nuclear data compilations and evaluations, and recommended that they be continued to be published until the time of the next meeting.

3. The meeting recommended that existing standard nuclear data reference files be used whenever possible in the performance of horizontal compilations and evaluations in order to reduce the proliferation of reference values.

4. The meeting agreed to accept the Oak Ridge report ORNL-5054/R1 as the basis for the users' manual for the computer-based ENSDF (Evaluated Nuclear Structure Data File) system. The Nuclear Data Project was given the responsibility to maintain the manual and to distribute it to the members of the NSDD network.

5. The meeting adopted a procedure to update the ENSDF manual, and agreed to differentiate between major and minor changes to the ENSDF system and devised procedures for their implementation.

6. The international NSDD network members concerned accepted the assignment of specific mass chains as a permanent basis to assure the continuous and complete evaluation of all mass chains on a four year cycle.

7. The meeting accepted procedures to assure a four-year evaluation cycle and agreed to a set of procedures for the reassignment of primary mass chain evaluation responsibilities.

8. The meeting agreed to adopt the standards and procedures for the evaluation of mass chain nuclear structure and decay data as proposed by the Nuclear Data Project.

9. The meeting accepted a set of interim procedures to review and referee mass chain evaluations performed by members of the NSDD network.

10. The meeting agreed on the set of physical properties to be compiled and evaluated in context of the mass chain data evaluation effort.

11. The meeting agreed that the international NSDD network should meet approximately every other year, but without exceeding 2.5 years between two consecutive meetings. The next meeting of the NSDD network was suggested to be held in Leningrad, USSR, during the first quarter of 1980.

II. SUMMARY AND HIGHLIGHTS OF THE DISCUSSIONS

A. Introductory Items

The opening of the meeting by A. Lorenz, Deputy Head of the IAEA Nuclear Data Section and Scientific Secretary of the meeting, was followed by welcoming addresses by Dr. A. Zucker, Associate Director for Physical Research of the Oak Ridge National Laboratory and Dr. S. Whetstone, representative of the Division of Basic Energy Sciences of the United States Department of Energy.

B. Status Reports from NSDD Network Members

Status reports made by the members of the NSDD network are reproduced in this report as Appendices. The current status of A-chain evaluations, based on information provided in the status reports, is summarized in Table I. Summary of the order of these presentations and the reference to the relevant Appendix is given below.

1. U.S. Position on International Cooperation in the area of Nuclear Structure Data, N. Holden, Appendix 5. (Recorded as AG-105/4).

2. Statement on CBNM Activity in Evaluation and Compilation, W. Bambynek, Appendix 6. (Recorded as AG-105/5).

3. Organization of the Nuclear Structure and Decay Data in the USSR, L.L. Sokolovskij and F.E. Chukreev, Appendix 7. (Recorded as AG-105/6).

4. Compilation and Processing of Nuclear Structure and Nuclear Reaction Information at the LIYaF Data Centre of the Academy of Sciences of the USSR, I.A. Kondurov and Yu.V. Sergeyenko, Appendix 8. (Recorded as AG-105/7).

5. Status Report on Utrecht Evaluation Activities, C. van der Leun, Appendix 9. (Recorded as AG-105/8).

6. Status Report. Zentralstelle für Atomkernenergie-Dokumentation (ZAED), Federal Republic of Germany, H. Behrens and J.W. Tepel, Appendix 10. (Recorded as AG-105/9).

7. Status Report: U.K. Nuclear Structure Data Evaluation, P.J. Twin (University of Liverpool), Appendix 11. (Recorded as AG-105/1).

8. Status Report. Nuclear Structure Data Evaluation Project in Kuwait, A. Shihab-Eldin, Appendix 12. (Recorded as AG-105/10).

9. Status of Japanese Activities in Nuclear Structure and Decay Data Compilation, Tsutomu Tamura (Nuclear Data Center, Japan Atomic Energy Research Institute), Appendix 13. (Recorded as AG-105/11).

Table I

A-Chain Evaluation Progress as of November 1977

US/NNDC	A=141 completed and reviewed A=142 completed, sent for review A=143 evaluation in progress
US/INEL	A=157, 159 Evaluation in progress
US/NDP	Prepared revised versions of 49 mass-chains during past 18 months and assisted with five additional mass chains. (See also Nuclear Data Sheets).
US/UP	A=18, 19 and 20 evaluation completed A=5-10 evaluation to be initiated end 1977, expected completion in 1978.
NED/UTRECHT	A=21-39 evaluations completed A=40-44 evaluations in progress A=21-44 evaluations to be published in 1978
FRG/ZAED	A=84, 85, 87, 91 and 92 evaluations in progress
UK/Daresbury	A=70 evaluation completed A=71 evaluation to be completed in 1978
KUW/ISR	A=77 evaluation to be completed in 1978
JAP/JAERI	A=121 evaluation in progress A=123, 125, 127 to be evaluated next
USSR/KUR	A=2, 242 evaluation in progress

10. Status Report. Nuclear Structure Data Evaluation in Sweden, B. Erlandsson (University of Lund). Appendix 14. (Recorded as AG-105/12).

11. Status Report on Nuclear Decay Data Evaluation. CNEN (Bologna). G. Reffo. Appendix 15. (Recorded as AG-105/13).

12. Activities at the KFA-Juelich on the Collection of Nuclear Data for Activation Analysis. Gerhard Erdtmann (Nuclear Research Establishment Juelich, Federal Republic of Germany). Appendix 16. (Recorded as AG-105/33).

C. Review of Actions

Most May 1976 NSDD Meeting Actions which referred to agenda items of this meeting were discussed in the course of this meeting under the pertinent agenda item. For the full text of the 1976 Actions, the reader is asked to refer to Appendix 4 of the 1976 NSDD Meeting Summary Report (INDC(NDS)-79/LN).

Action 1	See Appendix 17. Relegated to Agenda Item E.2.
Action 2	See Appendix 18. Relegated to Agenda Item I.1.
Action 3 and 3a	The draft report of "The Nuclear Structure Reference (NSR) File" was discussed under Agenda Item E.1.
Action 4	Relegated to Agenda Item F.1.
Action 5	Relegated to Agenda Item F.1.
Action 6	See Appendix 19.
Action 7	See Appendix 20. Discussed under Agenda Item G.2.
Action 8	See Appendix 20. Discussed under Agenda Item G.2
Action 9	No requests for CODEN descriptors have been received by IAEA/NDS.
Action 10	Sample letter sent to East European countries is included in Appendix 21; positive responses have been received from Romania and Bulgaria.
Action 11	List of Nuclear Data Project Computer Programmes was distributed by US/NDP in September 1976 as NS-Memo 1B/76. It is included here as Appendix 22.
Action 12	Discussed under Agenda Item F.1.
Action 13	Discussed under Agenda Item F.1.a and G.1.a.
Action 14	Discussed under Agenda Item G.2.a. See Appendix 23.
Action 15	Discussed under Agenda Item D.2.
Action 16	Discussed under Agenda Item D.2.
Action 17	Discussed under Agenda Item D.2.
Action 18	Discussed under Agenda Item D.1.
Action 19	Action completed.
Action 20	Discussed under Agenda Item D.3.

Action 21 Results presented at the Second FPND Specialists' Meeting indicated the existence of discrepancies between published FPND compilations. That meeting recommended an additional compilation in an effort to resolve the discrepancies.

Action 22 Discussed under Agenda Item D.3.

Action 23 This action was extended to all evaluators, and discussed in more detail under Agenda Item G.2.f.

Action 24 Discussed under Agenda Item F.1.

Action 25 See final agreement in Agenda Item H.

Action 26 Was converted to standing action.

D. Horizontal NSDD Compilation and Evaluation

1. Several completed or on-going selected compilations and evaluations were discussed:

   a) The "1977 Atomic Mass Evaluation" by A.H. Wapstra and K. Bos was published in ADNDT Vol. 19, No. 3 (March 1977). The availability of this new evaluation on magnetic tape was going to be investigated by US/NDP. Actions 2 and 3.

   b) A new compilation of Spins and Moments by I.A. Kondurov et al. (LIYaF) is to be published in 1978. The compilation is currently available as preprint or on magnetic tape on request from the USSR State Committee on Atomic Energy (the IAEA/NDS has requested the information on magnetic tape and will have it available on request).

   c) A preliminary version of a compilation of "Isotopic Composition of the Elements and their Variation in Nature", by N.E. Holden, has been published in the BNL report BNL-NCS-50605 (March 1977). **A more complete version is being prepared by an IUPAC "Subcommittee on Assessment of Isotopic Composition" and will be available in two years time.**

   d) CBNM/Geel maintains a file of fluorescence yields and intends to perform a new L-shell evaluation. In addition, a compilation of experimental values of internal conversion coefficients and their ratios for nuclides of $Z<60$ is in progress. (See also CBNM/Geel status report, Appendix 6).

   e) A compilation of monoenergetic gamma rays resulting from (p,γ) and (α,γ) resonances in $A<45$ nuclei, covering approximately 90 % of the 5-11 MeV gamma ray energy range has been prepared at the Fysisch Laboratorium at Utrecht, and is to be published in Nucl. Instr. and Methods. Also in preparation at Utrecht are an updated compilation of "Strengths of Electromagnetic Transitions for $A < 45$", and a set of recommended γ-ray calibration energies. (See also NED/Utrecht status report, Appendix 9).

f) The GAMDAT file of gamma-ray data is currently being revised at Juelich and is expected to be available for distribution through the IAEA/NDS in the beginning of 1978. Approximately 80% of the data in the revised GAMDAT file is based on information taken from the Nuclear Data Sheets. (See also FRG/Juelich progress report, Appendix 16).

Members of the network were encouraged to inform the network of any on-going or planned horizontal compilation through the established system of NSDD Memoranda.

In context of the discussion on horizontal compilations and evaluations it was emphasized that selected retrievals from ENSDF, the computer file of evaluated nuclear structure data maintained by US/NDP, can be requested through the NSDD network; and that special computer programmes are available (e.g. MEDLIST) for use at other centers for selective retrieval and edited output from the ENSDF file for the preparation of specialized decay data files.

In this latter context, it was reported that US/INEL has prepared two specialized decay files based on the ENSDF data base: one on fission product decay data, the other on actinide decay data.

Further discussion of horizontal compilations led to the following recommendation:

Recommendation 1

Where standard reference files of parameters useful to horizontal compilations and evaluations are available, it is recommended that they be used whenever possible in order to reduce the proliferation of reference values.

2. Wall Chart of Nuclides

The status of several "Wall Chart" publication programmes was announced.

a) United States: a new edition of the General Electric wall chart has been completed and will be available for distribution at the end of 1977. The US will continue to publish a wall chart on a 4-year cycle, with next edition expected by the end of 1981.

b) Federal Republic of Germany: the next edition of the "Karlsruhe" wall chart is planned to be published at the beginning of 1980 in the same format. It is planned to maintain a 4-year publication cycle.

c) Japan: there are two independent wall chart efforts in Japan. The Japanese Nuclear Data Center (JNDC) at JAERI has published a Chart of Nuclides in February 1977 which has received world-wide distribution; it is planned to be updated every four years. The Nishina

Memorial Foundation, whose last chart was published in 1970 is currently collecting data for the next edition.

d) USSR: the Soviet wall chart effort is to be clarified, and its current status and publication plans are to communicated to the network.

e) France: the French wall chart effort is to be investigated by Rambynek (Action 1) and communicated to the NSDD network.

As most groups involved in the production of wall charts of the nuclides are not directly related to the NSDD network, the data given on currently published wall charts are not necessarily based on the ENSDF data base. In order to achieve a reasonable degree of agreement among the data thus published, it was suggested that ENSDF be used as the basis for the data included in all wall charts of nuclides.

3. Compilation of Evaluations

Three separate compilations of nuclear data compilations and evaluations are produced by members of the NSDD network:

a) The "Compilation and Evaluation of Nuclear Structure and Decay Data", published annually by the IAEA Nuclear Data Section, last issue, No. 3, distributed in October 1977. Each issue supersedes previous one completely. Scope is restricted to nuclear structure and decay data.

b) The "Data Compilation in Physics", published by the Zentralstelle für Atomkernenergie-Dokumentation in the Federal Republic of Germany. First volume published in 1976, supplement issued in 1977, plan to issue one supplement per year. Scope covers all fields of physics.

c) "A Source List of Nuclear Data Bibliographies, Compilations and Evaluations", published by the United States National Nuclear Data Center, at the Brookhaven National Laboratory. First issue was published in August 1977 as report BNL-NCS-50702. Plan to publish once a year. Scope covers all of nuclear physics.

The meeting recognized the usefulness of these compilations, and emphasized the importance to have a wide distribution of these publications. In this context it was recommended that Holden (US/NNDC) send the three versions of compilations of compilations to Dr. Katharine Way (editor of ADNDT) and discuss with her the possibility to publicize this effort in ADNDT and/or publish one or a combination of these compilations in ADNDT. (See Action 14).

Although it was recognized that there exists a certain amount of duplication between the three compilations of compilations, the meeting concluded that all three continue to be published until the time of next meeting, at which time they would be re-evaluated.

E. Bibliographic Reference Systems

1. Nuclear Structure Reference File (NSR)

a) File description

The Nuclear Structure Reference (NSR) file is the comprehensive compilation of keyworded bibliographic NSDD references used for the periodic publication of Recent References in the Nuclear Data Sheets journal, for the preparation of special collections of bibliographic citations for special topics (including all reference lists for the mass-chain evaluations published in Nuclear Data Sheets), and for the preparation of responses to inquiries for specifc nuclear information. The NSR file has keyworded information back to 1960, but it is currently considered complete for published literature back to 1969; the coverage of report literature is not systematic.

Description of the NSR file as described in the draft document AG-105/25 was presented by Ewbank (US/NDP). This draft document is not included in this meeting report; it is to be finalized and issued early in 1978, at which time it will be distributed to the network.

b) Distribution of the NSR File

It was agreed that the NSR file would be distributed by US/NDP through the US/NNDC to the distribution centers of the international NSDD Network according to the following schedule:

- full file distributed once a year, plus
- supplements distributed twice a year (every 4 months).

c) File purging

A systematic method to purge the NSR file was deemed necessary, and was given to US/NDP to develop. Feedback from individual evaluators and other file users is expected to help keep the file purged.

d) Dissemination of bibliographic information

Chukreev (USSR/CAYaD) mentioned that certain documents cited in the NSR file are not available in the USSR, which posed a

problem for the data evaluators. It was suggested that IAEA/NDS provide microfiches of the missing reference documents through the auspices of INIS, or that IAEA/NDS serve as a repository of NSDD documents required by evaluators. In view of the large volume of reference material involved, it was agreed that the USSR centres could request the required reports from IAEA/NDS on an ad hoc basis. If the needed reference material was not available from INIS, IAEA/NDS would request it from the pertinent network centre, either in the form of a hard copy or as microfiche and forward it to the requesting centre in the USSR.

2. INIS

In response to Action # 1 ascribed to Behrens at the May 1976 NSDD meeting to answer whether INIS could be used as a bibliographic reference system for NSDD by comparing INIS to Recent References for a few specific cases, Tepel (FRG/ZAED) presented the findings of this comparison. The comparison is included in this report as Appendix 17.

F. International Nuclear Structure Data File

1. Evaluation File

The Evaluated Nuclear Structure Data File (ENSDF) is the computer-based file for all nuclear structure and decay data compiled, evaluated, exchanged, published and disseminated by the international NSDD network. The ENSDF is made up from a collection of "data sets", each of which describes the results of a single experiment or the combined evaluated results of a number of experiments of the same type. It is designed to be used as a storage file for compiled and evaluated data, as a source file for specialized output and publications, and as a vehicle for the exchange of data among the members of the NSDD network.

a) Status report

The current status of ENSDF as presented by Bertrand (US/NDP), is summarized in Table II (distributed as AG-105/22 at the meeting). The ENSDF Data Bank Inventory as of July 17, 1977 is shown in Figure 1 (distributed as AG-105/23 at the meeting). The gaps were expected to be closed before the end of 1977, and as a result of continuous recycling of evaluations, the file at the present time does not contain evaluated data which was originated before 1970. All mass-chain information published in Nuclear Data Sheets is included in the ENSDF file.

Table II

Current Status of the Evaluated Nuclear Structure Data File

ENSDF

EVALUATED NUCLEAR STRUCTURE DATA FILE

CONTAINS (5/1/77)

≈190,000 CARD IMAGES

≈10^6 DATA ITEMS

ORGANIZED -

1700 ADOPTED LEVELS

1400 DECAY SCHEMES

2000 NUCLEAR REACTIONS, ETC.

RETRIEVABLE -

BY NUCLEUS (A, Z, AND/OR N)

BY CLASS (ODD-A, EVEN-N = 200-214, ETC.)

BY REACTION OR DECAY

BY REFERENCE

OUTPUT -

LEVEL-SCHEME DRAWINGS

TABLES OF NUCLEAR PROPERTIES

TABLES OF ATOMIC AND NUCLEAR RADIATIONS

COMPUTER FILES OF NUCLEAR PROPERTIES

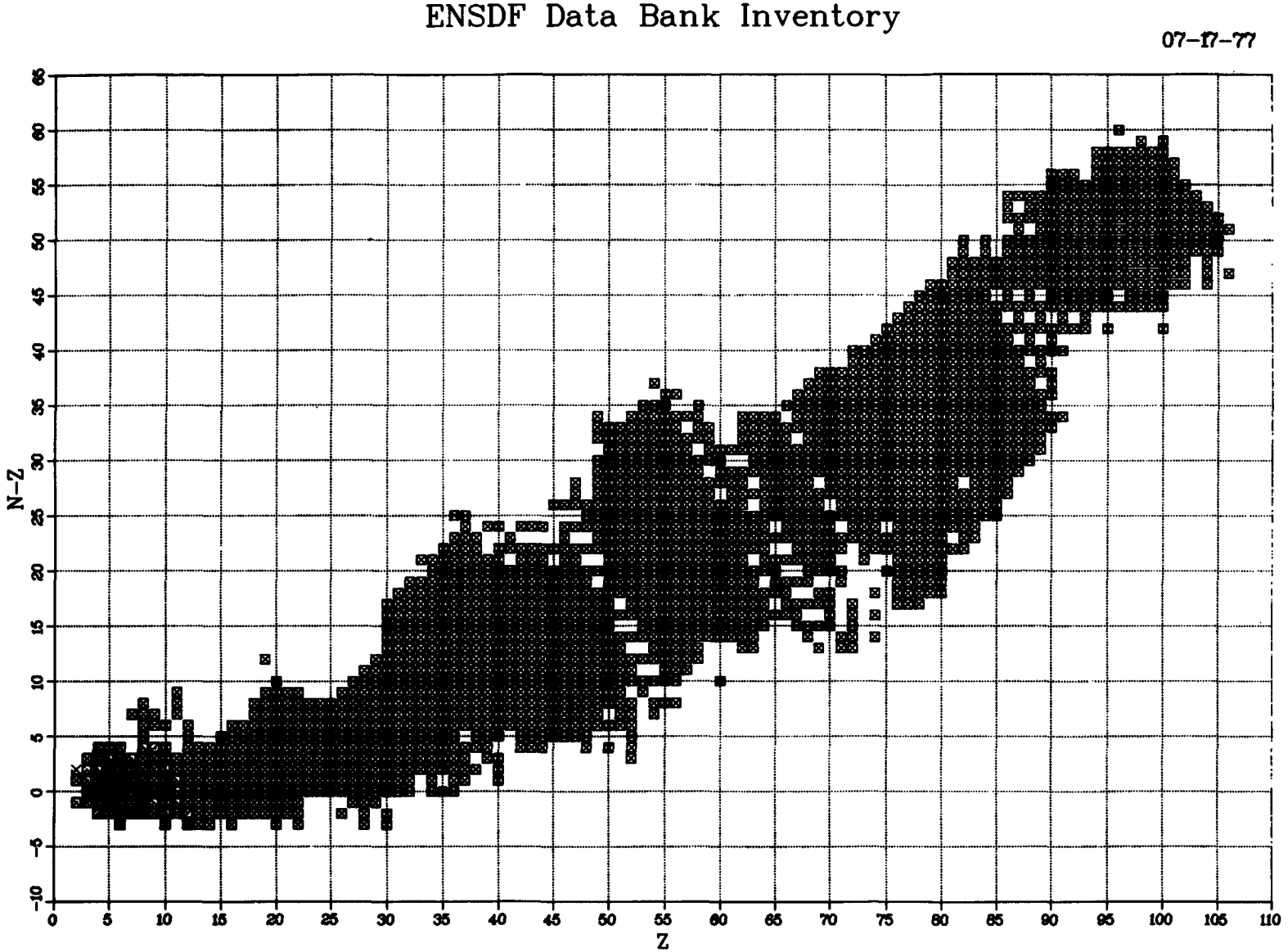
ENSDF Data Bank Inventory
07-17-77
N-Z
Z
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110
-10
-5
0
5
10
15
20
25
30
35
40
45
50
55
60
65

Figure 1

b) and c) Documentation, File Description and Purging

The description of ENSDF, its structure and content and general use instructions, as described in the report "Evaluated Nuclear Structure Data File, a Manual for Preparation of Data Sets", ORNL-5054/R1 (distributed as AG-105/24 at the meeting) were reviewed by Ewbank (US/NDP).

ENSDF User Manual

In response to the suggested need for a system manual, it was agreed that ORNL-5054/R1 be accepted as the basis for the ENSDF User Manual.

The Nuclear Data Project was designated as the center responsible for the maintenance of the manual, and as the center to distribute accepted changes to the system. It was suggested to have a loose-leaf manual, and to have changes distributed on replacement sheets which should be so labelled as to make the implemented change evident.

Procedure to handle changes and alterations to the ENSDF system

Two different types of manual changes were identified: major procedural changes and minor correction changes.

It was concluded that major changes to the ENSDF system and to the format should not be instituted between meetings of the international network at the present time, and that any such change be preceded by a dissemination of proposals using the established nuclear structure memoranda.

It was also concluded that minor changes, such as correction of errors in the ENSDF file, additions to dictionaries which do not change the basic system, etc., be introduced by the NDP through the system of NS memoranda.

Members of the network were generally cautioned against introducing changes to the ENSDF system, and to do so only if sufficient experience justifies a suggested change. In any event any major change to be contemplated at a meeting of the network should be preceded by an extensive exchange of memoranda.

File purging and procedure to handle corrections to the file

Errors found by members of the network in the ENSDF file should be communicated to the US/NDP. It is then the responsibility of the US/NDP to correct all errors in the file and to advise all members of the network of these corrections. (See Standing Action 3).

All changes to the system and corrections to the data file introduced into ENSDF will be documented and distributed to the network by US/NNDC when the ENSDF update is distributed.

In addition to the "feedback method" to correct the ENSDF file described above, it was suggested that a checking programme, to screen new input to ENSDF, be developed.

ENSDF Associated computer programmes

Existing computer programmes designed to operate on the ENSDF data base (i.e. data set prepared in the standard ENSDF format) are described in Appendix 2 of ORNL-5054/R1 (page 27).

A magnetic tape containing these computer programmes, updated as new programme versions and improvements are introduced, will be supplied periodically to the member of the network (on request) by the Nuclear Data Project. This ENSDF programme package will also include a computer programme to "manage" the data (e.g. retrieve information from file); this programme is written to be used in an IBM environment; the intent of US/NNDC as time allows, is to convert some codes to "computer-independent" formats for the benefit of the NSDD network. The current content of the ORNL/NDP Programme tape, as of March 1977, is given in Table III.

It was also suggested that all other centers which develop computer programmes to handle ENSDF data, advertise their existence through NS memoranda and make them available to other members of the network on request (see Standing Action 2).

d) Exchange and Dissemination Procedure

It was agreed that the complete (updated) ENSDF file will be sent by US/NNDC to all distribution centres of the NSDD network (i.e. USSR/CAJaD, FRG/ZAED and IAEA/NDS) every six months, and to any other NSDD network center on request.

2. Working File

In addition to the ENSDF master file, the existence of another file in ENSDF format has been foreseen for the convenience and optional use of NSDD network members.

This working file has been suggested to be used for the following purposes:

- the re-cycling of mass chain evaluations,
- the storage of selected groups of data for analysis or evaluation by standard ENSDF processing programmes,
- for the storage of data compiled when performing horizontal evaluations,

Table III

ORNL/NDP PROGRAM TAPE. NOVEMBER 1977

This tape contains 15 files, which include working versions of most NDP programs for data analysis, storage, and display as of March 15, 1977. Tables of constants used by some programs are also included, as well as a sample data deck. The files are described in more detail on the following pages The files are listed below.

File	Name	Language	Logical record length	Block size
1	String Manipulation	Assembly	80	800
2	GTOL	Fortran IV	80	800
3	LOGFT	Fortran IV	80	800
4	Atomic Wave Functions (File 49 for LOGFT)	Data	80	800
5	HSICC	Fortran IV	80	800
6	HS Table-Builder	PL/1 + JCL	80	800
7	HS Tables (Input for HS Table-Builder)	Data	42	840
8	JCL for NDSLIST + A = 184 data sets	JCL + Data	80	800
9	MEDLIST	Fortran IV	80	800
10	Atomic Properties (File 49 for MEDLIST)	Data	80	800
11	NDSLIST	PL/1	80	800
12	JCL for START44	JCL	80	800
13	START44	PL/1 + JCL	80	800
14	FETCH44	PL/1	80	800
15	SAVE44	PL/1	80	800

- for the storage of data published in preprints and laboratory reports having limited distributions,
- the storage of preliminary or alternate mass chain evaluations.

The content of the "working file" is to be communicated to members of the NSDD network in the form of a current content index which would be sent out by US/NDP in the form of NS memoranda.

Although the main "working file" is to be kept at Oak Ridge by the US/NDP, the existence of other ENSDF working files established for the convenience and use at other NSDD centers, has also been suggested.

It was left as an action (Action 6) on all centers to evaluate the usefulness of the ENSDF working file, and to report on it at the next meeting.

G. Nuclear Structure Data Evaluation

1. Evaluation Content

a) and b) Data types and procedures

All data types currently contained in ENSDF are included in the description of the data file, given in ORNL-5054/R1.

A general discussion of improvements to the data content of the ENSDF file led to three specific suggestions:

(i) that the weak and strong arguments for isobaric spin assignment in the evaluation of light nuclei be summarized and made available to the network evaluators (resulted in Action 8),

(ii) that evaluators inform the network of any additional set of rules for spin and parity assignment, and

(iii) that it would be extremely useful to the nuclear structure physics community to have a compilation of normalized spectroscopic factors for heavy nuclei.

c) Programmes

In response to an action from the May 1976 meeting, Ewbank outlined the content of the report of abstracts of computer programmes used by the NDP during preparation of Nuclear Data Sheets. This report, which had been issued earlier as NS Memo-1B/76-1, was presented at the meeting as AG-105/16; it is included in this report as Appendix 22.

2. Evaluation Standards

As the topics under this agenda item departed somewhat from those originally suggested, the titles given in the text do not always correspond with those listed under G.2 in the Adopted Agenda.

a) Physics of evaluation

Two reports, based on the rules and procedures developed and implemented at the Nuclear Data Project, were presented by Ewbank (US/NDP):

- "Physical Properties compiled and evaluated by the Nuclear Data Project", ORNL, can be considered as a guideline for the minimum content of a standard A-chain evaluation included in the Nuclear Data Sheets. This report was distributed at the meeting at AG-105/17, and is included in this report as Appendix 23, and

- "Standards for ENSDF Data Sets", is a description of the minimum information to be included in an ENSDF data set. This report, submitted at the meeting as AG-105/27, is included in this report as Appendix 24.

The meeting endorsed the guidelines and rules outlined in the two reports and accepted their extension to the international NSDD network.

A discussion of evaluation rules resulted in the following recommendation (No. 2), which outlines the mechanism for the introduction of changes in spin and parity assignment rules:

Recommendation 2

(i) The current "summary of bases for spin and parity assignments", as described in the introductory pages of the Nuclear Data Sheets, are to be used as the initial rules in the process of evaluation;

(ii) Alternate rules for spin and parity assignment which may be devised by evaluators from time to time should be submitted to the network in the form of NS-Memoranda;

(iii) It will be the responsibility of US/NDP to review the proposed changes and suggestions, and distribute the recommended changes in the form of NS-Memoranda.

b) Mechanics of evaluation

The paper describing the mechanics involved in the process of mass-chain evaluation, "Normal Procedure for Mass-Chain Evaluation", was presented by Ewbank (US/NDP). The discussion which followed resulted in the following two specific changes to the original text: the option to appoint more than one Referee was suggested, and the role of the Editor was deemed to be more than just administrative. In addition, paragraph 15 was changed to comply with subsequent changes in the A-Chain Review Procedures. (See next Section: Review Procedures). This paper was submitted to the meeting as AG-105/28, it is reproduced here, as amended, in Appendix 25.

The report as amended was accepted by the meeting to serve as the general guideline for the procedures to be followed in the evaluation of mass-chain data by the international NSDD network.

c) Review procedures

At the May 1976 meeting of the NSDD network considerable concern was expressed by the delegates over the effect on the quality of the Nuclear Data Sheets due to the introduction of new evaluators (both US and non-US) into the production of Nuclear Data Sheets. The request for the establishment of a review procedure was supported by many delegates, but was postponed to this meeting to allow time to focus on the establishment of the network itself.

In response to this concern, a paper entitled "A Proposal for A-Chain Review Procedures" was submitted to the meeting (AG-105/29) and presented by Holden (US/NNDC). In the course of extensive discussions during which the establishment of a formal Review Board, proposed in the original paper, was seriously questioned, it was decided to omit any reference to a Review Board at the present time and re-examine the overall review procedures at the next IAEA NSDD meeting.

The following are the revised mass-chain evaluation review procedures which were provisionally adopted by the NSDD network until the time of the next IAEA NSDD meeting. It was left as an action (Action 10) on the network to distribute to the members of the network suggestions for changes in the adopted review procedures (i.e. regarding the manner in which the Editor and the Referees are chosen, and the formation of the Review Board).

REVIEW PROCEDURES

(i) Every A-chain to be published in the Nuclear Data Sheets journal will be refereed.

(ii) Editor
It is the Editor's responsibility to select referees, send evaluations and guidelines to referees, consider referees' comments, send those comments which in his judgement are pertinent within the established guidelines to evaluators, consider evaluators' response, and supervise the review procedure (see below).

The Editor, presently W.B. Ewbank, will be selected from the Nuclear Data Project.

(iii) Referees
a. The referee should be an experienced nuclear scientist from the international community.
b. A scientist should preferably not be asked to referee more than one A-chain per year.
c. NDP staff will referee the first A-chain from every new evaluator.
d. Referee's comments and objections must be specific.
e. In no case will a referee rewrite an A-chain.
f. Referee will be anonymous.

(iv) Arbitration
The responsibility of resolving disagreements between authors and referees is assigned to the Editor.

The Editor will consult with other experienced evaluators of NSDD to resolve such disagreements.

For the present, the Editor retains authority to make final decisions about the content of Nuclear Data Sheets.

(v) These review procedures will be re-examined at the next IAEA NSDD Meeting.

d) Additional Items

(1) Legal Aspects
A discussion on the copyright of information contained on magnetic tape led to a request to IAEA/NDS to investigate if there is any international copyright agreement which could affect the exchange of NSDD information recorded on magnetic tape and the eventual publication of this information (Action 9).

(2) Citing of major discrepancies
A discussion of this topic concluded that adequate publicity is given to data discrepancies during the normal evaluation procedure and that no additional mechanism is required.

(3) Terminology
It was concluded that a list of accepted nuclear structure quantities with their explanations was important, and it was left as an action on US/NDP (Action 11) to draw up and circulate to the network a list of recommended NSDD terminology and definitions.

3. Evaluation Publications

The following points regarding the publication of mass chain evaluation data were made:

(1) In view of the continuously increasing body of experimental NSD data, it was suggested that in order to prevent increase of the Nuclear Data Sheet journal price, that thought be given to decreasing the number of pages of each published mass chain evaluation by making the information layout more compact and/or by including only part of the information which is stored on the ENSDF tape.

(2) Consideration was given to a request to provide copies of individual mass chain evaluations (e.g. as reprints of Nuclear Data Sheets articles) to members of the network. It was left as an action on US/NDP (Action 12) to investigate the availability and price of additional reprints of published mass-chain evaluations in Nuclear Data Sheets.

(3) The new Handbook of Isotopes publication is planned to be published four years after the publication of the last issue of the "Table of Isotopes (i.e. in 1982). It was left as an action on US/NNDC (Action 13) to present at the next meeting a description and status report on the publication of the Handbook of Isotopes.

(4) A brief description was given by Ewbank (US/NDP) of a book on level systematics which is planned to be published in 1978. This book is not planned to be as comprehensive as the "Nuclear Level Schemes A=45 through A=257 from the Nuclear Data Sheets" (Academic Press, 1973), but will contain information on all A-chains which will be sorted by nucleon number rather than by mass chain number.

4. Support Services

- Bertrand (US/NDP) presented a summary of support services provided by US/NDP to other evaluation groups. This paper, submitted to the meeting as AG-105/21, is given here as Appendix 26.

- Holden (US/NNDC) summarized the services provided by the NNDC to the NSDD network and introduced report BNL-NCS-23375 (October 1977) describing the "Physics Analysis Programmes for Nuclear Structure Evaluation". The computer programmes described in the report were developed by US/NDP for IBM system/370, and subsequently modified by US/NNDC to be used on Digital Equipment Corporation's DEC system 10/20 and Control Data Corporation's CDC 6000/7000 series computers. Most of the assembly language subroutines have been re-written in the FORTRAN-IV language. This report submitted to the meeting as AG-105/21, is not included in this report. The physics analysis codes described in the report are available on magnetic tape from US/NNDC.

- Chukreev (USSR/CAJaD) described the services provided to other centres in the Soviet Union. Additional services are also provided to other countries, such as Hungary, on request; this includes retrievals of bibliographic data from Recent References, and the dissemination of NSDD references from the Soviet Union.

- Twin (UK/Daresbury) expressed his appreciation for the services provided by US/NNDC and US/NDP during the 18 months since the establishment of the NSDD network, and commented on the valuable nature of the system which was set up at the May 1976 NSDD meeting.

H. Mass Chain Evaluation Responsibilities

The assigned responsibilities for mass-chain evaluation as agreed by the NSDD network at this meeting are listed in Table IV. These assignments were accepted as a permanent operating basis for achieving an evaluation of all mass chains on a four year cycle.

Furthermore, the following text (reproduced from the paper submitted by US/NNDC to the meeting as AG-105/32) which summarizes procedures for the reassignment of primary evaluation responsibilities, was agreed to by the meeting participants; it is given in its entirety on the following page.

Procedures for assuring a four-year cycle of mass chain data evaluations was proposed by US/NNDC (see paper AG-105/31). The proposal was accepted by the meeting and is presented as amended in the text below.

The total amount of evaluator time committed by the NSDD network evaluation centres and groups to the mass chain evaluation effort as of January 1978 was figured to approximately 25. The manpower commitment of each evaluation group, as of January 1978, is given in Table V.

PRIMARY RESPONSIBILITY FOR MASS CHAINS

Basic scientists have always attempted to work freely as individuals on any research problems which interest them. However, in the case of a service activity such as the preparation of evaluation of nuclear structure and decay data, there must be some agreed upon efficient procedures for coordinating the work of many groups of nuclear scientists.

Although continued responsibility for the same mass chains is considered to be most efficient, transfer of primary responsibility may be necessary to sustain interest of the centers concerned in the evaluation effort and to insure long-term success of the cooperative program.

Some Comments on the Reassignment of Primary Responsibility

1) If a center falls substantially behind in its program for two successive years.
2) If a center requests a reduction.
3) An existing center must have a good record to qualify for an increase in its mass-chain responsibility.
4) New groups should start by collaborating with the existing centers.
5) Reassignments can be made bilaterally between existing centers.
6) Formal acceptance of such reassignments should take place at IAEA meetings with advance notice of mass regions of interest.

Table IV

Mass Chain Assignments as of 16 November 1977

A-Range	Responsible NSDD Evaluation Groups
1-4	USSR
5-20	US/UP
21-44	NED/UTRECHT
45-64	US/NDP
65-80	UK/Daresbury including KUW/ISR
81-100	FRG/ZAED
101-117	US/NDP including SWD/Lund
118-129	JAP/JAERI
130-135	USSR
136-145	US/NNDC
146-152	US/LBL
153-162	US/INEL
163-194	US/LBL
195-237	US/NDP
238,240,242,244	USSR
239,241, 243	US/NDP
245-∞	US/NDP

PROCEDURES FOR ASSURING A FOUR-YEAR CYCLE

(i) Each year US/NDP will make reasonable estimates of A-chain production for the year, based on the status of the ENSDF tape. For each center, US/NDP will recommend priority evaluations for that coming year with a forecast for an additional year. IAEA/NDS will distribute the annual status and request the various centers to send their evaluation schedule to IAEA/NDS and US/NNDC.

To insure a four-year cycle, 25%, on the average, of a center's mass-chain commitment must be evaluated in any given year.

It is noted that efforts such as those of Endt and van der Leun, and Ajzenberg-Selove have consistently recycled evaluations approximately every four ± 1 years.

(ii) If a center fails to meet its scheduled evaluations at the end of the year, this information will be given to the NSDD Network.

(iii) In consultation with IAEA/NDS, US/NNDC will contact the center concerned and encourage it to make an increased short-term effort to regain the four-year cycle; alternately, the center may request a temporary reassignment of the deficient mass chains in their commitment.

(iv) If a center is unable to make the necessary special commitment before mid-year, US/NNDC, in consultation with US/NDP, and IAEA/NDS will arrange for temporary reassignment of the deficient mass chains. This reassignment is for one revision only, and will not normally affect the center's formal commitment.

Table V

Manpower Commitment of Evaluation Groups

(As of January 1978)

Evaluation Group	Manpower Commitment (given in man-years (MY) of evaluator time)
US/NNDC	2 MY plus 1 or 2 support
US/NDP	7½ MY plus 1 or 2 support
US/LBL	3 MY plus 1 support
US/INEL	1 MY plus 2 support
US/UP	½ MY plus ½ support
USSR/CAJAD	3 MY plus support staff } plus contracts with
USSR/LIYAF	1 MY plus support staff } other organizations
NED/UTRECHT	⅔ MY
UK/DARESBURY	¾ MY
FRG/ZAED	3 MY plus 1 support
JAP/JAERI	1 MY plus support staff
SWD/Lund	½ MY
KUW/ISR	1 MY

I. Miscellaneous

1. Publicity for NSDD products

- In the United States, the NSDD effort has been publicized through the professional societies directly through the Panel on Reference Nuclear Data which brings together representatives of major professional societies in the US, and at a specially organized session of an American Nuclear Society meeting.

- As described in Section D.3 above, it was recommended that a combined version of the three compilations of compilations produced by NSDD network members be published in the journal Atomic Data and Nuclear Data Tables.

- It was also urged that NSDD evaluators and the evaluation centers publicize their work at meetings and in journal articles, and that serious effort be made to have NSDD evaluation recognized as a professional nuclear physics activity.

- It was also recommended that evaluation centers advertise the existence and functions of the international NSDD network in publications of the various national physical societies.

2. Liaison with journal editors

- In response to an action put on IAEA/NDS at the 1976 Meeting of the NSDD Network, IAEA/NDS in cooperation with US/NDP sent a letter to Editors of twenty four scientific journals, requesting that they adopt the Recent Reference Keywork System. The list of journals which were approached and the copy of the letter sent is included in this report as Appendix 18.

- In the Soviet Union, the formation of the international NSDD network has been widely publicized. At the last National Conference on Nuclear Spectroscopy and the Structure of the Atomic Nucleus, held in Tashkent in 1977, it was announced that the next publication of the proceedings of this conference, published by the USSR Academy of Sciences, would include "Recent References" keywords (in English). For this purpose, a translated description of the Recent Reference keywords has been prepared for the benefit of the contributors to these proceedings.

3. Association of evaluators with on-going research

The evaluation groups represented at the meeting reported that most evaluators engaged in NSDD evaluations were devoting 30-50 percent of their time to research. The recommendation made in this regard at the May 1976 Meeting of the NSDD Network, was confirmed and recommended to be regarded as a standing recommendation; it reads:

> "It is strongly recommended that evaluators devote part of their time to research programmes in order to maintain their expertise."

J. Concluding session

1. Other topics and unfinished business

- The report of the adhoc Subcommittee on the "Recommendations for J$^{\pi}$ Assignments and Other Related Matters", was given by its chairman C. van der Leun. The transcription of this subcommittee report is given in Appendix 27.

- The chairman reminded the members of the network of the NS-memorandum communication system adopted at the last meeting, and suggested that the list of "Active and Potential Members of the NSDD Network" (see Appendix 27 of the Summary Report of the May 1976 Meeting, INDC(NDS)-79/LN), be brought up-to-date. The current list of NSDD network members and their addresses is given in Appendix 28.

2. Summary of conclusions and recommendations

The meeting reviewed the conclusions and recommendations which were proposed during the meeting. These are included in the text of this report.

3. Review of actions arising from this meeting

The actions which resulted from the discussions during the meeting are listed in Appendix 4.

4. Future meetings

The discussion about future IAEA NSDD meetings led to two specific suggestions which reflected the general inclination of the NSDD network members to use the occasion of these meetings to have an opportunity to discuss the physics aspects of NSDD evaluation. These suggestions are:

- to make plans to include discussion on physics questions concerning NSDD evaluation, at the next NSSD meetings, and if possible

- to schedule meetings of the international NSDD network to take place in conjunction with larger nuclear structure physics meetings.

It was also agreed that IAEA NSDD meetings should meet approximately every other year, but without exceeding 2.5 years between two consecutive meetings.

The next IAEA meeting of the NSDD network was suggested to be held in Leningrad, USSR, during the first quarter of 1980, at the time and place of the Soviet meeting on Nuclear Spectroscopy and the Structure of the Atomic Nucleus.

Advisory Group Meeting on Nuclear Structure and Decay Data

Oak Ridge National Laboratory, USA
14-18 November 1977

List of Participants

Ajzenberg-Selove, F. (observer)	US/UP	University of Pennsylvania Philadelphia, Penns. 19174, USA
Bambynek, W.	CBNM/Geel	Bureau Central de Mesures Nucleaires C.E.C. Steenweg naar Retie B-2440 Geel, Belgium
Behrens, H.	FRG/ZAED	Fachinformationszentrum Energie, Physik, Mathematik G.m.b.H. Karlsruhe Kernforschungszentrum D-7514 Eggenstein-Leopoldshafen 2
Bertrand, F. (local secretary) (observer)	US/NDP	Nuclear Data Project Oak Ridge National Laboratory Oak Ridge, Tennessee 37830, USA
Chukreev, F.E.	USSR/CAYaD	Institut Atomnoi Energii I.V. Kurchatova 46 Ulitsa Kurchatova Moscow, D-182, USSR
Erdtmann, G.	FRG/Juelich	Kernforschungsanlage Juelich Ges.m.b.H. Postfach 1913 D-5170 Juelich
Erlandsson, B.	SWD/Lund	Institute of Physics University of Lund Soelvegatan 14 S-223 62 Lund, Sweden
Ewbank, B.	US/NDP	Nuclear Data Project Oak Ridge National Laboratory Oak Ridge, Tennessee 37830, USA
Fuller, E.G. (observer)		National Bureau of Standards Washington, D.C. 20234, USA
Heath, R.L. (observer)	US/INEL	Idaho National Engineering Lab. 550 Second Street Idaho Falls, Idaho 83401, USA
Holden, N.	US/NNDC	National Nuclear Data Center Brookhaven National Laboratory Upton, New York 11973, USA
Kondurov, I.A.	USSR/LIYAF	Data Centre Leningrad Nuclear Physics Inst. Gatchina, Leningrad Region 188350, USSR

Lederer, C.M. (observer)	US/LBL	Lawrence Berkeley Laboratory University of California Berkeley, Calif. 94720, USA
Lorenz, A. (scientific secretary)	IAEA/NDS	Nuclear Data Section International Atomic Energy Agency P.O. Box 590 A-1011 Vienna, Austria
Pearlstein, S.	US/NNDC	National Nuclear Data Center Brookhaven National Laboratory Upton, New York 11973, USA
Reffo, G.	ITY/CNEN	Centro di Calcolo del C.N.E.N. Via Mazzini 2 I-40138 Bologna
Shihab-Eldin, A.	KUW/ISR	Kuwait Institute for Scientific Research Shuwaik, Kuwait
Sokolovskij, L.L.	USSR/CAYaD	Institut Atomnoi Energii I.V. Kurchatova 46 Ulitsa Kurchatova Moscow, D-182, USSR
Tamura, T.	JAP/JAERI	Japan Atomic Energy Research Inst. Division of Physics Tokai-Mura, Naka-Gun Ibaraki-Ken, 319-11, Japan
Tepel. J.	FRG/ZAED	Fachinformationszentrum Energie, Physik, Mathematik G.m.b.H. Karlsruhe Kernforschungszentrum D-7514 Eggenstein-Leopoldshafen 2
Twin, P.J.	UK/Daresbury	Oliver Lodge Laboratory University of Liverpool Liverpool L69 3BX, UK
Van der Leun, C.	NED/Utrecht	Fysisch Laboratorium Sorbonnelaan 4 Utrecht, The Netherlands
Whetstone, S.L.	(US/DOE)	Nuclear Sciences Division of Basic Energy Sciences U.S. Dept. of Energy Washington, D.C. 20545, USA

Advisory Group Meeting on Nuclear Structure and Decay Data

Oak Ridge National Laboratory, U.S.A.
14-18 November 1977

Adopted Agenda

Monday AM and PM

A. Introductory Items
   1. Opening statements
   2. Election of Chairman
   3. Adoption of Agenda

B. Status Reports from NSDD Network Members
   1. Manpower commitment
   2. Organization of centers
   3. Support facilities now available at centers
   4. A-chain completion dates and progress

C. Review of Actions which Resulted from the May 1976 Meeting

D. Horizontal NSDD Compilations and Evaluations
   1. Selected evaluations
      a) Atomic masses
      b) Spins and moments
      c) Isotopic abundances
      d) Wall chart
   2. Selected compilations
      a) Specialized decay data files
      b) Half-life compilations
   3. Compilation of evaluations
      a) IAEA
      b) FRG
      c) US

Tuesday AM and PM

E. Bibliographic Reference Systems
   1. Recent References
      a) Status report
      b) Documentation
      c) File description and purging
      d) Exchange and dissemination procedures
      e) Use and application of file at centers
   2. INIS

F. International Nuclear Structure Data File

1. Evaluation File

a) Status report
b) Documentation
c) File description and purging
d) Exchange and dissemination procedure

2. Working File

Wednesday AM

G. Nuclear Structure Data Evaluation

1. Evaluation Content

a) Data types
b) Procedures
c) Programmes

2. Evaluation Standards

a) Documentation
b) Data to be considered
c) Minimum data required for a data set
d) Minimum data sets required for a nuclide
e) Review procedures
f) Citing of major discrepancies
g) Terminology

3. Evaluation publications

a) Nuclear Data Sheets
b) Table of Isotopes
c) Handbook of Isotopes

4. Support Services

H. Mass Chain Evaluation Responsibilities

I. Miscellaneous

1. Publicity for NSDD Products
2. Liaison with journal Editors
3. Association of evaluators with on-going research

Thursday AM

J. Concluding Session

1. Other topics and unfinished business
2. Summary of conclusions and recommendations
3. Review of actions arising from this meeting
4. Future meetings

List of Papers Presented at the Meeting

As in the previous NSDD Meeting report (INDC(NDS)-79/LN), only part of the papers presented at this meeting are included in the Summary Report as Appendices, some are incorporated into the text of the report, and others, as in the case of published reports, have not been included. References to the latter category are made directly in the text of the report. (Cross-reference to Appendix number is given in parentheses).

AG-105/1 Status Report: UK Nuclear Structure Data Evaluation. P.J. Twin. (Appendix 11)

AG-105/2 Contributions from East European Countries to Recent References. A. Lorenz. (Appendix 21)

AG-105/3 Letter to Editors of Physics Journals. A. Lorenz. (Appendix 18)

AG-105/4 U.S. Position on International Cooperation in the Area of Nuclear Structure Data. N.E. Holden. (Appendix 5)

AG-105/5 Statement on CBNM Activity in Evaluation and Compilation. W. Bambynek. (Appendix 6)

AG-105/6 Organization of the Nuclear Structure and Decay Data in the USSR. L.L. Sokolovskij and F.E. Chukreev. (Appendix 7)

AG-105/7 Compilation and Processing of Nuclear Structure and Nuclear Reaction Information at the LIYaF Data Centre of the Academy of Sciences of the USSR. I.A. Kondurov and Yu.V. Sergeyenko. (Appendix 8)

AG-105/8 Status Report on Utrecht Evaluation Activities. C. van der Leun. (Appendix 9)

AG-105/9 Status Report. Zentralstelle für Atomkernenergie-Dokumentation (ZAED) Federal Republic of Germany. H. Behrens and J.W. Tepel. (Appendix 10)

AG-105/10 Status Report. Nuclear Structure Data Evaluation Project in Kuwait. A. Shihab-Eldin. (Appendix 12)

AG-105/11 Status of Japanese Activities in Nuclear Structure and Decay Data Compilation. Tsutumo Tamura. (Appendix 13)

AG-105/12 Status Report. Nuclear Structure Data Evaluation in Sweden. B. Erlandsson. (Appendix 14)

AG-105/13 Status Report on Nuclear Decay Data Evaluation. CNEN (Bologna). Appendix 15)

AG-105/14 Comments on the Evaluation Report INDC(CCP)-75/LN. W.B. Ewbank, N.E. Holden, C.M. Lederer. (Appendix 19)

AG-105/15 Letters relating to the spin and parity assignment rules. M.J. Martin and H. Behrens. (Appendix 20)

AG-105/16 Nuclear Data Project Computer Programmes (September 1976). (Appendix 22)

AG-105/17 Physical Properties Compiled and Evaluated by the Nuclear Data Project, ORNL. (Also distributed as NS Memo 1B/72-2, Revised October 1977). (Appendix 23)

AG-105/18 Panel on Reference Nuclear Data and Surveys of Reference Data Requirements, BNL-NCS-50717. Ed. by. T.W. Burrows and S. Pearlstein. (September 1977). (Not included).

AG-105/19 A Source List of Nuclear Data Bibliographies, Compilations and Evaluations, BNL-NCS-50702. T.W. Burrows and N.E. Holden. (August 1977). (Not included).

AG-105/20 Recent Additions to a Source List on Nuclear Data Bibliographies, Compilations, and Evaluations. Addendum to BNL-NCS-50702 (private comm.). T.W. Burrows and N.E. Holden. (24 October 1977). (Not included).

AG-105/21 ORNL/NDP Support Services to other Evaluation Groups. (4 November 1977). (Appendix 26)

AG-105/22 ENSDF - Evaluated Nuclear Structure Data files. (Included in text).

AG-105/23 ENSDF Data Bank Inventory, 17 July 1977. (Included in text).

AG-105/24 Evaluated Nuclear Structure Data File, a Manual for Preparation of Data Sets. ORNL-5054/R1. W.B. Ewbank and M.R. Schmorak. (November 1977). (Not included).

AG-105/25 The Nuclear Structure Reference (NSR) File. W.B. Ewbank. (Draft). (Not included; to be released at later date).

AG-105/26 Comparison of the International Nuclear Information System (INIS) and Recent References (RR), ZAED-M-13. H. Behrens and J.W. Tepel. (October 1977). (Appendix 17)

AG-105/27 Standards for ENSDF Data Sets. (Also distributed as NS Memo 1B/3(77). (25 October 1977). (Appendix 24)

AG-105/28 Normal Procedure for Mass-chain Evaluation. (Draft, 4 November 1977). (Appendix 25)

AG-105/29 A proposal for A-Chain Review Procedures. (15 November 1977). (Included in text).

AG-105/30 Physics Analysis Programmes for Nuclear Structure Evaluation, BNL-NCS-23375/R. B.J. Barton and J.K. Tuli. (October 1977). (Not included).

AG-105/31 Procedure for Assuring a Four-year cycle. (15 November 1977). (Included in text).

AG-105/32 Primary Responsibility for Mass Chains. (15 November 1977). (Included in text).

AG-105/33 Activities at the KFA-Jülich on the Collection of Nuclear Data for Activation Analysis. G. Erdtmann. (18 November 1977). (Appendix 16)

AG-105/34 ORNL/NDP Programme Tape Content. (16 November 1977). (Not included in text).

AG-105/35 Isotopic Composition of the Elements and their Variations in Nature: A Preliminary Report, BNL-NCS-50605. N.F. Holden. (March 1977). (Not included).

AG-105/36 Bulletin of the Leningrad Institute of Nuclear Physics (LIYaF). No. 4 (February 1977). Content:
1. Full α-widths of neutron resonances, Yu.M. Gledenov, et al.
2. Rotational bands of odd-odd nuclei ($150 \leq A \leq 190$), V.G. Dubro. (Not included).

AG-105/37 Bulletin of the Leningrad Institute of Nuclear Physics (LIYaF), No. 5 (June 1977). Content: Description of the computer programme set RAINE. "Relativistic Atom. Interaction of Electromagnetic Radiation and Nucleus with Atomic Electrons", J.M. Band, M.A. Listengarten, M.B. Trzhaskovskaya, V.I. Fomichev. (Not included).

AG-105/38 LIYaF Report No. 289 (December 1976). Description of the Computer Programme set RAINE. Part I. Numerical Methods of Relativistic Calculations of Atomic Structure and Electromagnetic Processes in Atoms. I.M. Band, et al. (Not included).

AG-105/39 LIYaF Report No. 298 (January 1977). Description of the Computer Programme set RAINE. Part II: Description of Additional Materials of RAINE. Common Blocks and Identifiers, I.M. Band, et al. (Not included).

AG-105/40 LIYaF Report No. 299 (January 1977). Description of the Computer Programme set RAINE. Part III: Description of the Computer Programmes, I.M. Band, M.B. Trzhaskovskaya, V.I. Fomichev. (Not included).

AG-105/41 LIYaF Report No. 300 (January 1977). Description of the Computer Programme set RAINE. Part IV: Description of the Programmes which calculate the Internal Conversion Coefficients (ICC) and the Relativistic Photoeffect (PHOTO). I.M. Band, M.B. Trzhaskovskaya. (Not included).

Actions

1.	Bambynek	Find out about the French wall chart effort.
2.	US/NDP	After consultation with Wapstra, provide Wapstra's latest masses compilation on tape to NNDC for network distribution on request.
3.	US/NNDC	If available, send tape of Wapstra's masses compilation to other centres on request.
4.	Network	Send to NDS reports on specialized decay data compilations.
5.	IAEA/NDS	Set up a distribution list for the distribution of NSDD reports.
6.	Network	Evaluate the use of the working file in the ENSDF format.
7.	Network	Report on experience with the machine-independent computer codes made available to the network that are designed to handle the ENSDF file.
8.	van der Leun	Distribute the draft rules derived for light nuclei on arguments used for isobaric spin assignment.
9.	IAEA/NDS	Investigate with IAEA if there is any international copyright agreement which could affect the exchange of NSDD information recorded on magnetic tape and its eventual publication.
10.	Network	Suggestions for changes in the adopted review procedures (i.e., appointment of editor and referees) (See Section G.2. Review Procedures) should be distributed so that they reach the participants no later than one month before the next IAEA NSDD meeting.
11.	US/NDP	Draw up and circulate to the network a list of recommended NSDD terminology and definitions.
12.	US/NDP	Investigate the availability and price of additional reprints of published mass-chain evaluations in Nuclear Data Sheets.
13.	US/NNDC	Present at the next meeting a status report on the publication of the Handbook of Isotopes.
14.	Holden	Send the three versions of the Compilation of Compilations to the editor of ADNDT (Dr. Katharine Way) and discuss with her the possibility to publicize this effort in ADNDT and/or publish one or a combination of these compilations in ADNDT.

Standing Action List

1. Send copies of all relevant NSDD network correspondence to the Nuclear Data Section.

2. All centers, in particular US/NDP, should distribute on a regular basis those computer codes which could be useful to other centers.

3. US/NDP should communicate to the network all errors discovered in the ENSDF file and all changes made to the ENSDF file.

4. All network evaluators should follow the general guidelines (included in AG-105/24, AG-105/27, AG-105/28, and AG-105/29) for mass-chain evaluation.

IAEA Advisory Group Meeting on Nuclear Structure and Decay Data for Applications

Oak Ridge, Tennessee, 14-18 Nov. 1977

U.S. Position on International Cooperation in the Area of Nuclear Structure Data

Presented by Norman E. Holden, National Nuclear Data Center, Brookhaven National Laboratory

I. Introduction

At the nuclear structure and decay data (NSDD) meeting 18 months ago in Vienna, the opening U.S. statement emphasized the advantages of international cooperation in the compilation and evaluation of NSDD information; it described what the United States thought was needed, and what the United States could do in a cooperative effort.

To facilitate international cooperation, the U.S. is coordinating several U.S. evaluation groups as a Nuclear Data Network (USNDN)* via the National Nuclear Data Center at BNL, who also negotiate with other international evaluation groups to avoid an unnecessary duplication of efforts. Liaison with U.S. scientists is being pursued to supplement efforts of the evaluating centers.

The U.S. National Academy of Sciences has established a permanent panel on nuclear data compilations which periodically reviews the work of the U.S. Nuclear Data Network.

In addition, a Panel on Reference Nuclear Data (PRND), a continuing board comprised of representatives from professional societies covering basic and applied nuclear sciences, is convened once a year at NNDC to provide better awareness of nuclear data evaluation efforts on the part of the science community, the professional societies, and editors of scientific journals, and to provide feedback on the data needs and services which these groups require.

*USNDN is comprised of BNL-National Nuclear Data Center, INEL-Nuclear Physics Branch, LBL-Table of Isotopes Project, NBS-Photonuclear Data Center, ORNL-Nuclear Data Project, and U. Pennsylvania-Energy Levels of Light Nuclei

Since international cooperation is now a reality, we would like to review U.S. progress since the last IAEA meeting and the current status and to point out those items which still need to be done. A number of technical proposals will be made in detail later at the appropriate agenda item; these will, therefore, be only briefly summarized here. We also present in the following a brief status report from each of the U.S. evaluation centers.

II. Publications

The present status and future plans of some publications of interest to the NSDD Network are:

A. Wall Chart of Nuclides - A new edition of the General Electric wall chart has been completed. Forty thousand copies will be printed and available for distribution at the end of the year. It is the intention of the U.S. to continue producing a wall chart with the next edition appearing by the end of 1981.

B. Table of Isotopes - The seventh edition is nearly completed. It will contain approximately 1200 pages and will be published by John Wiley and Sons in the Spring of 1978. This will be the last edition for the Table. In the future, the U.S. plans to produce a Handbook of Isotopes on a four year schedule. This handbook will include information on radioactive decay properties of interest to applied users.

C. Recent References - Beginning in 1978, three issues per year of Recent References will continue to be published but the third issue will be cumulative for the whole year.

D. Nuclear Data Sheets - The U.S. has increased the number of pages published to accommodate the evaluations anticipated from new evaluation groups in the NSDD Network.

E. Adopted Level Properties - Beginning in 1978 the U.S. plans to publish, on a four year cycle, a book containing a summary of the adopted level properties from ENSDF.

III. Primary Resource Files

A. Evaluation File (ENSDF)** - Three editions of the master file of evaluated data have been distributed to international data centers and others upon request; one in July 1976, another in January 1977, and most recently in July 1977. It is planned to continue to make the master file available at six month intervals.

B. Working File - As data on selected experimental values are provided by the evaluator, this file will be maintained and made available upon request.

C. Bibliographic File - Portions of this file dealing with pertinent mass chains are sent to the NSDD Network evaluators.

D. Specialized services - A Fortran version of some ORNL-NDP physics analysis programs has been produced and documented.

E. Auxiliary data - In addition to spectroscopic information, files of evaluated data on thermal neutron cross sections, resonance parameters, and isotopic abundances are maintained for wall chart and Handbook of Isotopes efforts.

IV. How the objectives of the NSDD are being accomplished

The U.S. Nuclear Data Network has implemented a procedure for insuring the four year cycle with the help of international cooperation and a review procedure for insuring the quality of the evaluations.

Details of the U.S. efforts will be presented during this IAEA meeting but the main features of the U.S. program are the following:

1. Mass Chains $A \geq 45$ will be published in Nuclear Data Sheets by NDP. Evaluations appearing in Nuclear Data Sheets will be refereed. A Review Board has been established and an initial membership chosen.
2. An international master file of evaluated data in the ENSDF format will be maintained by NDP. It will comprise evaluations accepted for publication in Nuclear Data Sheets and the $A \leq 45$ evaluations appearing in other journals.
3. The USNDN is active in contributing nuclear structure evaluations for the Nuclear Data Sheets.

**ENSDF is an NDP format accepted for international exchange by the IAEA NSDD Network

4. An international working file of experimental data received in the ENSDF format will be maintained by NDP.
5. A complete file of indexed nuclear structure references is maintained by NDP.

V. Servicing and Evaluations

The U.S. is committed to help new centers which are becoming established in the mass chain evaluation work. Services provided by the various centers in the USNDN are detailed in the attached status reports.

VI. What remains to be done

The prime objective is the completion of mass chain evaluations by each center on a four year cycle (~ 25% of a center's total mass chain commitment per year). A good start has been made and now the evaluations must be completed at a reasonable rate.

A review procedure (postponed from the Vienna meeting) must be adopted which will ensure the quality of the evaluations. Procedures for the temporary and permanent reassignment of mass chains among centers must be developed that will ensure the four year cycle, maintain the quality of evaluation and at the same time sustain the interest of the cooperating centers.

In addition to these priority objectives, consideration must also be given to appropriate horizontal evaluations.

VII. Status Reports of the U.S. Nuclear Data Network

A. BNL - National Nuclear Data Center

The evaluation of mass 141 has been completed and reviewed for inclusion in Nuclear Data Sheets. Mass 142 evaluation is complete and has been sent for review. Evaluation of mass 143 is in progress.

The ENSDF tape provided by NDP has been distributed to non-U.S. distribution centers and upon request to a number of other centers.

Physics analysis programs for nuclear structure evaluations originally developed by ORNL-NDP have been rewritten into a machine independent form version and documented in report BNL-NCS-23375. The programs include GTOL a least squares fit program to determine level energies and level feedings from measured gamma energies and their intensities, HSICC which interpolates

internal conversion coefficients between the tabulated values, and ANGCOR which determines the permissible level spin values and multipolarity admixtures from measured γ-γ directional correlations.

A Source List of nuclear data evaluations and bibliographies has been compiled and is available as report BNL-NCS-50702. It uses the American Institute of Physics' physics and astronomy classification scheme.

A bibliography of charged particle nuclear data has been published as report BNL-NCS-50640. It covers the literature published between January 1, 1976 and February 1, 1977. A new bibliography is planned for Spring 1978.

NNDC hosted a meeting of the National Academy of Sciences panel on nuclear data compilations and reported on the progress of the USNDN and the NSDD network. NNDC also hosted two meetings of the Panel on Reference Nuclear Data (PRND). The first PRND meeting has been documented in report BNL-NCS-50717.

An evaluation of the isotopic abundance values of the elements and their natural variation was published as report BNL-NCS-50605.

The master file of evaluated neutron data, ENDF/B, contains radioactive decay data on 825 fission product nuclides. These data were published in convenient book format in report BNL-NCS-50545.

The resonance parameter handbook BNL-325 is being revised. The physics specifications have been completed, an update of the data library is in progress with the data evaluation scheduled to begin in January 1978.

The NNDC Newsletter is published about eight times per year. NNDC offers services covering the entire field of low energy nuclear data. In the past, this has included information on neutron and charged particle reactions and nuclear structure and decay data.

Distributions of current versions of the entire international file of evaluated data, working file of experimental data and Recent References Files or retrievals of horizontal quantities will continue to be performed by the NNDC.

Computer compatible codes and other tools needed for effective interaction among cooperating centers are developed and provided by the NNDC.

NNDC has begun planning an evaluation of half lives of ground states and metastable states of one microsecond or longer.

B. INEL - Nuclear Physics Branch

The INEL formal involvement in mass chain evaluations began in the second half of this year, with receipt of funding for this purpose. The initial phase of the activity consisted of organization of the reference-data base and the conversion of three frequently utilized computer codes for use on the new INEL CDC-7600 computer system. These include an interpolation procedure for determining theoretical internal-conversion coefficients (calculated by Hager and Seltzer) for the K through the N+ shells. The "Data Bank" version of the ORNL LOGFT program was modified to accept tabular input rather than ENSDF-formatted input and the double-precision specifications have been removed. The third code modified is used to aid in the evaluation of decay-scheme data which have been placed in the ENSDF format. The gamma-ray transition intensity balance is calculated at each level and a gamma-ray placement consistency check and a least-squares level-energy adjustment are made. The overall gamma-ray intensity normalization can be calculated according to several specified options.

A second evaluator has been hired and begun work. Evaluations of the A=157 and 159 mass chains are presently in progress and about one-half completed.

C. LBL-Table of Isotopes Project

Production of the seventh edition of the Table of Isotopes is nearly completed. Over 300 of the anticipated 1200 pages are currently camera ready; the entire book should be completed and sent to the publisher around the end of the year. At that time, four evaluators (two full-time and two half-time) will begin mass chain evaluations for the USNDN. The Table of Isotopes project maintains an automated file of nuclear moments from which a compilation is published periodically. The last such compilation (1975) will be superseded by an appendix in the seventh edition of the Table of Isotopes.

The Project also supplies an on-line computer service which currently offers interpolated internal conversion coefficients, log ft values (and other beta decay properties), alpha decay hindrance factors, and vector addition coefficients. Information on use of the service is available from the Project. Use was provided to USNDN members on a no cost trial basis during the past year.

D. NBS-Photonuclear Data Center

While the major effort of the Photonuclear Data Center is now directed towards the completion of a comprehensive evaluation of the reaction data available for the p-shell nuclei it also continues to respond to requests for data tailored to meet the needs for specific applications and also to maintain its data index and bibliographic files current with the published literature to within a time lag of 2 months or less. It is expected that the technical aspects of the evaluation for the p-shell nuclei will be completed before the end of the current year and that the evaluation will be available for review early in 1978. It will be published in the Journal of Chemical and Physical Reference Data.

The Center had originally planned to publish the first supplement to NBS SP-380, Photonuclear Reaction Data, 1973 early this year. NBS SP-380 contains an annotated index to experimental data on the interaction of electromagnetic radiation with nuclei published in the period from 1955 through 1972. The Supplement was to include an updated data index that would supersede the interim index covering the period from January 1973 through May 1976 issued at the time of the 1976 Gordon Conference on Photonuclear Reactions. Due to various administrative and technical difficulties it was not possible to publish this supplement as scheduled. It is now due for publication in July 1978, to be available for distribution at the 1978 Gordon Conference on Photonuclear Reactions. This supplement will present a complete annotated index to experimental data published and entered into the Center's files in the period from January 1973 through March 1978. It will also contain an index to the cross section data available in the Center's digital data library. This library now consists of 1130 data sets pertaining to 75 elements and 128 different nuclides.

E. ORNL - Nuclear Data Project

In support of its data evaluation work, the NDP maintains a complete multiply indexed bibliography to nuclear structure references (NSR). The bibliography is computer based and serves as an international resource for scientific and technical research workers. References can be retrieved selectively by nucleus, reaction, or any other quantity mentioned in the keyword abstract.

During 1976, over 5000 references to new nuclear structure measurements and calculations were indexed and added to the NSR master file. New entries are sorted by topic and published three times each year in "Recent References" issues of Nuclear Data Sheets.

A magnetic tape version of the complete master NSR file (about 50,000 indexed entries, 1969-1974, in ORNL's ADSEP format) was sent to the Kurchatov Institute (U.S.S.R.) as part of the U.S. participation in an international exchange of nuclear structure information. The tape was successfully processed in Moscow, and a dialogue is being established to develop a format for routine exchange of indexed bibliographic information. A tape containing keyword abstracts for results reported at three recent Russian conferences was received from the U.S.S.R. These references (also in ADSEP format) are being merged into the NSR file.

Relevant new entries to the NSR file are distributed every month to each mass-chain evaluator. This regular service is being provided for 21 A-chain data evaluators. Three additional groups receive regular notification of new literature relevant to special data compilations (atomic masses, nuclear moments, photonuclear reactions).

Most requests for information received by NDP are at least partly satisfied by a search through the NSR file for references on a particular topic. The development and support of Oak Ridge Computerized Hierarchical Information System (ORCHIS) at ORNL provide convenient, inexpensive, and powerful search capabilities for ADSEP data bases. For long computer printouts, NDP has begun using the microfilm printer that recently became available. Although the device currently has a severely restricted character set, most information in the NSR file is understandable. The file of evaluated nuclear structure has grown by about 20% during the last 18 months by inclusion of additional evaluations from Nuclear Data Sheets. Nuclear level information on over 1700 nuclei are now summarized by ENSDF. Data from 1400 decay schemes are included, as well as structure information from over 2000 nuclear reactions.

Complete magnetic tape copies of the permanent master file ENSDF are prepared at six-month intervals for distribution by the National Nuclear Data Center (NNDC) at Brookhaven. Copies have also been sent directly to network groups in the United Kingdom and West Germany, together with programs for maintaining the ENSDF system in an IBM computer environment. A tape containing only decay-scheme data has been sent to Idaho National Engineering Laboratory (INEL) (to be used in preparing input for ENDF/B) and to Grenoble, France (for use in a similar radioactivity file). Data checking performed by each user provides information for further improvement in ENSDF quality and consistency.

The NDP data evaluation group prepared revised versions of 49 mass chains during the past 18 months and assisted with five additional mass chains published in Nuclear Data Sheets in collaboration with Nuclear Information Research Associates sponsored by the National Science Foundation. This was accomplished in addition to the increased work load caused by national and international collaboration in nuclear structure data evaluation.

A natural consequence of a systematic review of experimental data is the recognition of systematic trends or inconsistent results. The NDP has continued the policy of reporting such observations at scientific meetings as well as in the Nuclear Data Sheets.

Most NDP staff members are involved in research work in addition to their evaluation responsibilities.

The NDP publications group uses the master files of bibliographic and numeric data to prepare camera-ready copy for Nuclear Data Sheets. The computer programs which perform these tasks have been designed to take advantage of hardware and software maintained by the Computer Sciences Division in support of extensive information center activities at ORNL. During the past 18 months, the NDP prepared 12 A-chain issues and 5 issues of "Recent References" for publication in Nuclear Data Sheets. The A-chain issues contain complete revisions of Nuclear Data Sheets for 62 mass values.

Data for each mass chain were prepared in computer-readable ENSDF format; data sheets and drawings were assembled automatically from the ENSDF data sets; and the data sets have been filed onto the permanent master file of evaluated data.

A new section has been added to "Recent References" which contains an index to unpublished work that has been included in the NSR file during a four-month period.

Publication of the 1974-1976 reaction list for charged-particle reactions concluded the activities of the Charged-Particle Cross-Section Center at Oak Ridge. The Reaction Index section of "Recent References" indexes much of the same literature in slightly less detail. The NNDC at Brookhaven has assumed responsibility for investigating additional indexing required by users of charged-particle bibliographies. For users of radioactivity data, the Nuclear Data Project has compiled an extensive collection of decay scheme information. For this collection of about 400 nuclides, the nuclear decay information contained in ENSDF has been supplemented (by the addition of K, L, etc., internal conversion coefficients, average beta-energies, and K, L, etc., electron-capture branching ratios) so that a complete computer file of nuclear radiations plus x-ray and Auger-electron radiations can be produced by the NDP program MEDLIST. New decay schemes prepared for ENSDF will routinely include this information where available. For many of the data sets included in this collection, additional evaluation has been performed so as to include the results of new research published since the most recent complete mass-chain evaluation.

Other specific accomplishments of the past year are the following:

1. Three training sessions for new data evaluators have been organized and conducted.
2. The NDP hosted a meeting of the U.S. Nuclear Data Network, in Oct. 1976.
3. Complete copies of all data included in ENSDF were generated in July 1976, January 1977, and July 1977 for distribution to the network. Programs to maintain ENSDF in an IBM environment were also sent to the network evaluators in the United Kingdom and West Germany.
4. A tape containing several physics programs used by NDP in data evaluation was sent to other evaluator groups.
5. A complete indexed reference tape was sent to the Kurchatov Institute for use in the U.S.S.R. data evaluation effort. A tape containing indexed references to three Soviet conferences was received from Moscow in a similar format. The tape exchange is a step toward defining an acceptable format for exchange of bibliographic information.

6. Documentation of programs used by NDP for physics calculations was prepared for distribution to the networks. These programs have been developed by NDP and are used routinely to extend and to check ENSDF data sets. (Examples include log-ft calculation, internal-conversion-coefficient interpolation, and least-squares level calculation).
7. A review procedure for new A-chain evaluations has been drafted for study by the network.
8. At the request of the international network, NDP has drafted a list of suggested procedures for data evaluation. Agreement on certain standard procedures can simplify the review process and will assure some uniformity throughout ENSDF.
9. At the June 1977 meeting of the American Nuclear Society (ANS), NDP initiated and organized a special session to describe several sources of technical information for nuclear scientists and engineers. The special session was jointly sponsored by three ANS divisions.

F. U-Pennsylvania-Energy Levels of Light Nuclei

First drafts of A=18, 19 and 20 have been completed. Final drafts of A=18-20 will be submitted to Nuclear Physics in late fall or early winter. In December 1977, work on A=5-10 will commence with a 1978 completion date. A 4 1/2 year-cycle will be achieved by the end of 1978.

Statement on CBNM Activity in Evaluation and Compilation

W. Bambynek

1. Evaluation of orbital electron capture data

In collaboration with the ZAED, American, British, and German physicists a survey on "Orbital Electron Capture by the Nucleus" has been made and published [1]. The theory of nuclear electron capture is reviewed in the light of current understanding of weak interactions. Formulae and tables are provided that enable the reader to calculate transition rates and ratios of interest. Special attention is paid to electron-exchange and atomic wavefunction overlap effects on the transition probability.

Experimental methods for the measurement of electron-capture probabilities and ratios and of a electron-capture to β^+ -emission ratios are described and compared. Published data are listed, critically evaluated and compared with theory. The theory of radiative electron capture and experimental work on internal bremsstrahlung are thoroughly reviewed and tables for the calculation of internal bremsstrahlung spectra are provided. A discussion of atomic transitions that accompany nuclear electron capture is included. A special effort is made at completeness in covering the subject.

[1] W. Bambynek, H. Behrens, M.H. Chen, B. Crasemann, M.L. Fitzpatrick, K.W.D. Ledingham, H. Genz, M. Mutterer, R.L. Intemann, Rev. Mod. Phys. 49, 77-222 (1977).

2. Compilation of internal conversion data

A compilation of experimental results of internal conversion coefficients and their ratios for nuclides with $Z<60$ is in progress. The study is part of a corresponding compilation for all nuclides made in collaboration with the Max-Planck-Institut für Kernphysik, Heidelberg and the Zentralstelle für Atomkernenergie Dokumentation, Karlsruhe. It is restricted to data published later than November 1965. A similar compilation by J.H. Hamilton et al. [2] covers essentially all experimental values published earlier. The data were collected separately for radioactive decays, reaction processes, chemical and environmental anomalies, and EO-transitions. As far as possible also information on the experimental methods applied were collected. The study will be finished in 1978.

[2] J.H. Hamilton, A.V. Ramaya, B. van Nooijen, R.G. Albridge, E.F. Zganjir, S.C. Pancholi, J.M. Hollander, V.S. Shirley and C.M. Lederer, Nucl. Data A 1, 491 (1966).

ORGANIZATION OF NUCLEAR STRUCTURE AND DECAY DATA IN THE SOVIET UNION

L.L. Sokolovskij, F.E. Chukreev

(Paper for presentation at the meeting of the Advisory Group on Nuclear Structure and Decay Data, Oak Ridge, USA 14-18 November 1977)

(AG-105/6)

Moscow, 1977

1. Status and functions of the Centre for Atomic and Nuclear Data

Details on the structure, technical facilities and distribution of work within the Centre and also on its functions were presented at the Consultants' Meeting on Charged Particle Nuclear Data (CPND) Compilation, 8-14 September 1975 [1]. The number of staff at the Centre now numbers 16. By way of pointing up the role of the Centre in matters relating to non-neutron nuclear data in the USSR, we shall merely refer to its co-operation with outside organizations.

The Centre is the main organization in the USSR for the collection, evaluation and dissemination of non-neutron nuclear data.

All aspects of the Centre's activities are determined by the Nuclear Data Commission of the State Committee on the Utilization of Atomic Energy and its co-ordination group.

In co-operation with the Centre and on the basis of users' requests, a co-ordination group decides on the order of priority to be assigned to tasks connected with the compilation and evaluation of non-neutron nuclear data; this is with a view to arranging for their solution by appropriate groups set up at institutes of the State Committee on the Utilization of Atomic Energy and the USSR Academy of Sciences and at higher educational institutions. The co-ordination group also makes recommendations to the research laboratories of these institutes regarding measurements of essential non-neutron nuclear data and it can make changes in their research plans. The Centre carries on all these activities in accordance with recommendations of the Nuclear Data Commission and the co-ordination group.

The experience gained by the Centre in more than four years of work as the main organization in the USSR for the collection, evaluation and dissemination of non-neutron nuclear data demonstrates the effectiveness of the above-mentioned work plan chosen for carrying out the Centre's main task - meeting as fully as possible user requirements in respect of references and of numerical and evaluated data.

Extensive work on the compilation and evaluation of nuclear data is being carried on in the Soviet Union. The Centre is making basic materials available for this work and is co-ordinating the activities

involved. Examples of this are the studies entitled "The beta radiation of fission products" by V.M. Kolobashkin et al. and "Radioactive chains" by N.G. Gusev and P.P. Dmitriev, which are now being prepared for publication [2]. The nuclear data literature published so far has been circulated to Member States and to the Agency. The Centre is willing to continue sending Soviet-published literature on non-neutron nuclear data to Member States requesting it.

2. References

In line with the decisions taken at the preceding (1976) meeting, a bibliography in the Recent References format has been prepared in the Soviet Union for 1976. However, there are some difficulties in connection with this work. We understand that the deciding opinion in matters relating to bibliographical format must be taken by Oak Ridge. However, a letter Dr. I.A. Kondurov sent to Oak Ridge regarding the Russian transcription of the titles of papers has not yet been answered.

In preparing the references our main consideration was the convenience of the co-operating participants. However, not having received a reply from Oak Ridge, we were compelled, in order to fulfil the obligations of the Soviet Union, to send the material in the form in which it had been prepared.

A copy of the reference file for 1976 has not reached the Soviet Union and we do not know the reason for the delay. It may have to do with the format for transcribing the titles of Russian papers, in which case it is understandable. However, we had noted with some surprise the publication in Nuclear Data, Vol. 20, 1977, of an announcement to the effect that the Reference File as a whole is available only to a limited circle of persons, the list of whom is approved by ERDA. In this event we would most likely have to consider our earlier recommendations and obligations from a different point of view and to reconsider previously discussed matters of international co-operation and distribution of work.

Turning back to the documentation for the last meeting, we should like to receive a clarification from the American delegation concerning the final wording of paragraph C.I.8 of the Record of the 1976 meeting (page 7). It is stated in the Record that the documents included in

the Reference File and abstracted at Oak Ridge must be available to United States libraries for checking of key words as well.

It may be that the time has come for introducing greater precision into the entire procedure for transferring reference materials into the international file. In the interest of keeping a check on the quality of abstracting, we think it would be advisable to institute a system of selective control. In this case copies of essential documents could be sent to the Centre on request.

THE EVALUATION OF DATA ON NUCLEAR STRUCTURE AND RADIOACTIVE DECAY

1. Many of those present will probably remember that at the Vienna meeting of the Advisory Group in 1976 difficulties arose in connection with the allocation of responsibility for the evaluation of data in the regions of heavy as well as of light nuclei. This was a very difficult discussion but thanks to mutual concessions it resulted, after the meeting had been concluded, in a kind of temporary compromise solution which was satisfactory to all.

Accordingly, the Centre is now responsible for the mass chains 1-4 and 240, 242, 244 and 246. It is therefore quite natural that we are not presenting A = 239 or A = 9 to this meeting.

We have already prepared two A-chains:

1. A = 3

2. A = 242,

but for the time being we do not intend to transfer them to the international file.

We are not fully convinced that in the preparation of these materials account was taken of all scientific periodical publications which appeared in 1976. We did consider all Soviet publications but since the reference file for 1976 was not introduced into the network this uncertainty on our part is understandable. Not having the complete reference file, we cannot bring ourselves to present the evaluation results in the international ENDSF file, since the results of the evaluation seem somewhat unexpected even to us.

For the time being we are using these evaluations only inside the Soviet Union.

2. Although we are not transferring the data on the A = 3 and A = 242 chains to the international file, we are making available to the participants in the meeting the results of an analysis of the A = 95 chain covering the literature to the end of 1975. This material is recorded on magnetic tape and can be analysed by our colleagues at Oak Ridge. Our reason for making this presentation is that we want to familiarize ourselves with the critical observations of our colleagues regarding the content and form of the material submitted.

3. In preparing the materials for ENDSF and in the analysis of the copies of ENDSF we are encountering difficulties due to the fact that the rules are not sufficiently exact and unambiguous and to the contradictions between the main documents: ORNL - 5054 and Standards for ENDSF Data Sets.

The foregoing is the reason for our MEMO-NS/2A in which we propose making it obligatory for data concerning the type of decay to be included in the heading of the set.

4. We regret having to mention the non-performance of a number of activities during the past year, both concerning the documentation "Recent References", ENDSF and the description of the programme for checking the data going into ENDSF. This leads to an unnecessary waste of time and imposes on Oak Ridge a number of surplus obligations which could be satisfactorily assumed by the regional centres.

REFERENCES

[1] Consultants' Meeting on Charged Particle Nuclear Data (CPND) Compilation, Vienna, 8-12 September 1975, IAEA, INDC(NDS)-69, page 45-54, December 1975.

[2] Annotated plan for the publication of literature in 1978, Atomizdat, Moscow, 1977.

[3] INDC(NDS)-79/LN, December 1976.

77-10885
Translated from Russian

COMPILATION AND PROCESSING OF INFORMATION ON NUCLEAR STRUCTURE AND NUCLEAR REACTIONS AT THE DATA CENTRE OF THE LENINGRAD NUCLEAR PHYSICS INSTITUTE (LIYaF) OF THE USSR ACADEMY OF SCIENCES

I.A. Kondurov and Yu.V. Sergeenkov

The present communication describes the work of the Data Centre of the Leningrad Nuclear Physics Institute (LIYaF) of the USSR Academy of Sciences in the framework of the international network of centres and groups co-operating on the compilation and processing of information on nuclear structure and nuclear reactions that has been carried out since the meeting of the IAEA Advisory Group on Nuclear Structure and Decay Data for Applications held in Vienna between 3 and 7 May 1976.

1. The Centre has continued abstracting of Soviet papers containing data on the structure of the atomic nucleus and nuclear reactions.

The bibliographic file of the LIYaF Data Centre has been supplemented by new abstracts in key words covering the period 1976-77.

The format of the file approximates as far as possible to the NDS (Oak Ridge) format. Programs have been written for automatic translation of key words in accordance with the NDS dictionary and for translation of the Russian titles of journals into English. A trial tape with abstracts of papers from three conferences has been sent to Oak Ridge for purposes of agreeing on the format. However, a reply containing an analysis of the tape has not yet been received. Since there is not yet an agreed format the Data Centre is presenting to the meeting abstracts in a format without lower case letters.

To existing headings, apart from the < TITLE > headings in which the English translation of the Russian title of an article is given, the < RTITLE > heading has been added, in which the Russian title is transcribed in Latin characters. This duplication ensures that inaccuracies and differences in translation are avoided.

The LIYaF Data Centre has developed a system of programs for retrospective search for abstracts from key words (selectors), authors' names and journal titles. Analysis of the list of selectors has shown that it is necessary to extend their scope and to introduce into the < SELECTORS > a grammar which reflects the structure of the abstract in key words. It is also necessary to compile a thesaurus of selectors which would eliminate synonymy. It should have a fixed composition which is changed periodically by agreement. The Centre has attempted to compile such a thesaurus for the file containing abstracts of Soviet papers.

2. The LIYaF Data Centre has worked on the compilation of a file of evaluated papers containing data on nuclear structure from radioactive decay and nuclear reactions for the nuclear mass-chain A = 134, as was recommended by the previous meeting [1]. These data are recorded on magnetic tape in the ENSDF format. However, deviations from this format are quite possible since it has not been described in detail.

Problems of evaluation quality control have not been solved automatically since Oak Ridge has promised to offer quality control and editing programs to the network of centres and groups so that the Data Centre has not attempted to draw up such programs independently.

At the same time an attempt has been made at LIYaF to apply the ENSDF format at the input and output of programs for processing experimental nuclear data. In particular, this format has been used in the program on factorization of the three-dimensional matrix of $\gamma\gamma$-coincidences [2] for the introduction of data on the decay scheme of excited states of the nucleus being studied (this is necessary for the input of the matrix of possible coincidences). In this case, for the presentation of spectra processing results by analogy with the G-card the MG-card is introduced, which contains data on the position, area and other characteristics of the peak in the spectrum.

Work with the ENSDF format has shown that there is an urgent need to find a rational way of presenting experimental data on the internal conversion of transitions and on the intensity of coincidences.

In order to facilitate the work of evaluators, the Data Centre has translated into the ENSDF format and recorded on magnetic tape a paper produced at LIYaF [3] on the decay scheme of excited states of ^{122}Sb which was obtained with the (n,γ) reaction.

3. The drawing up of compilation files on the characteristics of excited states of nuclei has continued. A set of experimental lifetimes for excited states of nuclei has been prepared for publication in ADNDT, and a handbook on nuclear moments [4] has been published as a LIYaF preprint. In the Bulletin of the LIYaF Data Centre tables of experimental and calculated values for energies of rotational bands in odd-odd [5] and even-even [6] nuclei have been published.

Coefficients of internal conversion E1-M5 of transitions to K-, L- and M-shells and sub-shells for the nuclei from Z 3 to 104 in the energy ranges up to 2 MeV (L- and M-shells) and 6 MeV (K-shells) have been calculated and recorded on magnetic tape using the program system evolved by Prof. I.M. Band's group [7].

REFERENCES

[1] Summary Report of the IAEA Advisory Group Meeting on Nuclear Structure and Decay Data for Applications, INDC(NDS)-79LM, IAEA, Vienna (1976).

[2] EMEL'YANOV, B.A., KABINA, L.P., KONDUROV, I.A., TYUKAVINA, T.M., Tezisy dokladov XXVII soveshchaniya po yadernoj spectroscopij i strukture atomnogo yadra (Abstracts of papers from the XXVII Conference on Nuclear Spectroscopy and the Structure of the Atomic Nucleus), pub. Nauka, Leningrad (1977) (in Russian).

[3] ALEKSEEV, V.L. et al., "Skhema nizhnikh vozbuzhdennykh sostoyanij ^{122}Sb" (Scheme of low excited states of ^{122}Sb), to be published in Nucl. Phys. (in Russian).

[4] AVOTINA, M.P., ZOLOTAVIN, A.V., "Momenty osnovnykh i vozbuzhdennykh sostoyanij yader (Moments of ground and excited states of nuclei), Leningrad Nuclear Physics Institute (LIYaF), Leningrad (1976) (in Russian).

[5] DUBRO, V.G., Byulleten' Tsentra dannykh LIYaF (Bulletin of the Data Centre of the Leningrad Nuclear Physics Institute (LIYaF)), Leningrad, 4 (1977) 8 (in Russian).

[6] BEGZHANOV, R.B., BELEN'KIJ, V.M., ABDURAKHMANOV, S.R., VINARSKIJ, V.Sh., Byulleten' Tsentra dannykh LIYaF (Bulletin of the Data Centre of the Leningrad Nuclear Physics Institute (LIYaF)) 5 (1977) 4 (in Russian).

[7] BAND, I.M., LISTENGARTEN, M.A., TRZHASKOVSKAYA, M.B., FOMICHEV, V.I., Byulleten' Tsentra dannykh LIYaF (Bulletin of the Data Centre of the Leningrad Nuclear Physics Institute (LIYaF)), Leningrad, 5 (1977) 3 (in Russian).

STATUS REPORT ON UTRECHT EVALUATION ACTIVITIES

C. van der Leun

1. Energy levels of A = 21–44 nuclei (P.M. Endt and C. van der Leun). The sixth edition, to be published in Nuclear Physics, is expected to appear in 1978. So far the A–chains up to A = 40 have been evaluated; at present typing is the bottleneck. For each nucleus the review gives a master–table and tables for (in this order)
   - excitation energies
   - γ–ray branching ratios
   - mixing ratios
   - lifetimes
   - J^{π} and T–assignments
   - other quantities (resonances, S–factors, β–decay).

   This set–up should facilitate checking the work of the reviewers.

2. Spectroscopic factors for single–nucleon transfer in the A = 21–44 region (P.M. Endt). Published in ADNDT 19 (1977) 23.

3. Strengths of electromagnetic transitions for A < 45 (P.M. Endt, C. van der Leun), Nucl. Phys. A235 (1974) 27. Updating is planned following the completion of the sixth edition of the A = 21–44 review.

4. Gamma–ray energies (I.U.P.A.P. task–group: R. G. Helmer, P. Van Assche, C. van der Leun). A set of recommended γ–ray calibration energies is in preparation. The new very precise NBS "gold–standard" will play an essential role.

5. Monoenergetic γ–rays of variable energy from charged–particle capture. A list of γ–rays available from (p,γ) and (α,γ) resonances in A < 45 nuclei covering, e.g., about 90% of the E_γ = 5–11 MeV range, has been prepared for use in high–resolution resonance absorption, resonance fluorescence and photonuclear experiments. An article explaining the list has been accepted for publication in Nucl. Instr. and Methods.

STATUS REPORT

Zentralstelle für Atomkernenergie-Dokumentation (ZAED)

Federal Republic of Germany

H. Behrens and J.W. Tepel

1. Participation in the Nuclear Structure Data Cooperation

As announced during the last meeting, the work on the pilot evaluation for the mass chain A=86 has been completed. The results of this evaluation have been sent in printed form and on magnetic tape to Oak Ridge and are available for discussion during this meeting.

Since October 1977 we have a staff of 4, three of them scientists, for this project. This means that we are in a position to carry out the evaluation of 5 mass chains in 1978. The mass chains chosen are:

84, 85, 87, 91 and 92.

On the basis of experience gained so far, we should like to put up the following two points for discussion:

i) To regularly adjust the rules for the determination of spins and parities in the light of new developments;

ii) to find a way of including important gamma ray information in the system (e.g. adopted gamma decay scheme with branching ratios).

2. Comparison of the International Information System (INIS) and Recent References (RR)

In response to an action proposed during the last meeting a comparison of INIS and RR was made by us. For this study the mass chains A=27 and A=86 were chosen. The report has been distributed at this meeting for discussion.

3. Bibliography of existing Data Compilations

A bibliography is published by us at regular intervals. This publication gives a worldwide survey of all existing physics data compilations. Two issues have been published up to date:

Physikdaten/Physics Data 3-1, 1976
with the bibliographic data of about
1450 compilations

and

Physikdaten/Physics Data 3-2, 1977
with the bibliographic data of about
500 compilations.

All but a few of these compilations are part of a ZAED reference library.

4. Horizontal Compilations and Evaluations

One of the major objectives of the ZAED is to issue at regular intervals data compilations (and evaluations) for those subfields of physics not fully covered yet. A certain number of the items already published are of relevance to nuclear physics. A complete list is enclosed with this statement.

5. Wall Chart of Nuclides

The next issue of the German wall chart of nuclides (Karlsruher Nuklidkarte) will be published by the 'Institut für Radiochemie' of the 'Kernforschungszentrum Karlsruhe' at the beginning of 1980.

6. Change of name and responsibility of the ZAED

With the beginning of next year the ZAED will be part of an autonomous institution. Besides the ZAED, this new institution will include:

the 'Zentralstelle für Luft- und Raumfahrtdokumentation und -information';
the Editorial Department of the 'Physikalische Berichte';
the Editorial Department of the 'Zentralblatt für Didaktik der Mathematik'.

The name will be:

'Fachinformationszentrum Energie, Physik, Mathematik GmbH'
(National Information Centre for Energy, Physics, Mathematics).

The following fields will be covered:

Astronomy and astrophysics, aeronautics and astronautics, energy, mathematics, nuclear research and technology, physics.

This centre will have the responsibility for all information and documentation activities in the fields mentioned above for the Federal Republic of Germany.

PHYSIKDATEN/PHYSICS DATA

Already published:

Price/Preis plus postage/zuzügl Porto*

1 – 1 (1975) **Survey Index of Pion-Nucleon Scattering Data.** –
By K H Augenstein, G Hohler, E Pietarinen and H M Staudenmaier

56 pages Superseded by No 1 – 2 (1977)

1 – 2 (1977) **Survey Index of Pion-Nucleon Scattering Data.** 5,– DM
By K H Augenstein, G Hohler, E Pietarinen and H M Staudenmaier.

64 pages

2 – 1 (1976) **Stopping Cross Sections of Elements with Z = 2 to 87 for Li Ions with Energies between 80 keV and 840 keV.** 3,50 DM
By W Neuwirth, W Pietsch and U Hauser 6 pages

A compilation of experimental and calculated stopping cross sections

3 – 1 (1976) **Datensammlungen in der Physik. Data Compilations in Physics.** 14,– DM
By H Behrens and G Ebel 206 pages

A bibliography of about 1450 existing tables and compilations from all fields of physics

3 – 2 (1977) **Datensammlungen in der Physik. Data Compilations in Physics.** 7,– DM
By H Behrens and G Ebel – Supplement to No 3 – 1 (1976) 106 pages

4 – 1 (1976) **Compilation of Coupling Constants and Low-Energy Parameters. 1976 Edition.** 6,– DM

M M Nagels, J J de Swart, H Nielsen, C C Oades, J L Petersen, B Tromborg, G Gustafson, A C Irving, C Jarlskog, W Pfeil, H Pilkuhn, F Steiner and L Tauscher 90 pages Reprinted from Nuclear Physics B

A compilation of coupling constants and other parameters which characterize the interactions of elementary particles at low energies

5 – 1 (1976) **Gases and Carbon in Metals (Thermodynamics, Kinetics and Properties).** 9,50 DM
Part I Alkali Metals, Alkaline Earth Metals, Light Metals
(Li, Na, K, Rb Cs, Ca, Sr, Ba, Be, Mg, Al)

By E Fromm H Jehn and G Horz 26 pages

5 – 2 (1977) **Gases and Carbon in Metals (Thermodynamics, Kinetics and Properties).** 9,50 DM
Part II Group IIB to VB Metals
(Zn, Cd, Ga, In, TL, Ge, Si, Sn, Pb, Bi)

By E Fromm, H Jehn and G Horz 58 pages

6 – 1 (1976) **Shapes of Beta Spectra.** 4,50 DM
By H Behrens and L Szybisz 43 pages

A compilation of all measured beta spectrum shape factors

7 – 1 (1977) **Compilation of Pion Photoproduction Data** 19,– DM
D Menze, W Pfeil, R Wilcke 306 pages

8 – 1 (1977) **Optical Properties of Some Insulators in the Vacuum Ultraviolet Region.**
By R-P Haelbich, M Ivan and E E Koch

In preparation:

9 – 1 (1977) **Bibliography of Microwave Spectroscopy 1945 – 1975.**
By A Boggs, M Botskor, M Jones, K Kettemann, R Mutter, Ch Spreter and B. Starck.

* Im Inland kommen zu den angegebenen Preisen 5,5% Mehrwertsteuer

STATUS REPORT : U.K. NUCLEAR STRUCTURE DATA EVALUATION

P.J. TWIN

(University of Liverpool)

The U.K./Daresbury were allocated the long-term responsibility for A = 65-80 at the Vienna Meeting in May 1976.

The Science Research Council funded one post through the Daresbury Laboratory from 1st January 1977 for an initial 2 year period. Evaluation activities are centred at Daresbury but the post is funded via an agreement with Liverpool University and the position involves part-research and part-evaluation. It was filled by Dr. F. Kearns from 1st January 1977. He is assisted by Dr. J. Mo of Manchester University who is working part-time on Data Evaluation.

A visit was made to Oak Ridge in March 1977 to attend a course for new evaluators. Evaluation of A = 70 is proceeding and it is planned to have it complete by November 1977. Work will then commence on A = 71. Present indications are that the group will complete two mass chains (including A = 71) during 1978.

The group has collaborated with the University of Kuwait who expressed interest in assisting with the evaluations. They have commenced work on A = 77.

STATUS REPORT
NUCLEAR STRUCTURE DATA EVALUATION PROJECT IN KUWAIT

A. SHIHAB-ELDIN

1) Dr. Viggars from Kuwait University attended a compiler orientation meeting at Oak Ridge National Laboratory in March 1977. This enabled work to start on the collection of reference material. The collection of references is a slow process necessitating the obtaining of much material from abroad. Oak Ridge National Laboratory is helpful in supplying material which is not available locally. The Documents Section of Kuwait University Library is also obtaining material through their arrangement with the National Lending Library in U.K.

   Work in Kuwait has not progressed enough to make attendance at this meeting by a Kuwait compiler useful. However, Dr. Viggars hopes to visit Oak Ridge in February 1978, for a review of work completed by then.

2) An offer of employment has now been sent to one of the applicants for the research assistantship on the Nuclear Data Project in Kuwait. It is hoped that he will take up his duties as soon as possible. He should be able to visit Oak Ridge with Dr. Viggars in February. This R.A. position is funded by KISR.

   The research assistant will not only work on compilation and evaluation, but will be responsible for the development of the computational aspects of the project.

3) Two more post-doctoral research assistants will join the local effort at K.U. next September to assist on part-time basis in the project and to be trained as evaluators for the future.

4) Our plans currently call for the Kuwait team to work on mass chains 77-80. This was worked out in agreement with Daresbury group/U.K

5) First mass-chain evaluation (A = 77) is expected to be ready for review before next fall.

November 14, 1977

Status of Japanese Activities in Nuclear Structure and Decay Data Compilation

Tsutomu Tamura

Nuclear Data Center, Japan Atomic Energy Research Institute

I. Introduction

At the 1976 IAEA Meeting on Nuclear Structure and Decay Data, Nuclear Data Laboratory (now Nuclear Data Center), JAERI expressed an interest in the mass-chain evaluation[1]. After one year's examination of our status, we decided to participate in the international network of mass-chain evaluation. Through discussions between the coordination center BNL NNDC and us, the mass range A=118-129 has been allocated as the region of Japanese contribution. The first evaluation on A=121 is being performed by the Working Group on Nuclear Structure Data in Japanese Nuclear Data Committee.

The present status of mass-chain evaluation and horizontal compilation activities in Japan are described in this report.

II. Organization for NSDD activities

In the recent re-organization of Japanese Nuclear Data Committee, a Subcommittee on Nuclear Structure and Decay Data has been formed to include 3 working groups:

W.G. on Nuclear Data for Safeguards Techniques,

W.G. on Evaluation of Decay Heat,

W.G. on Nuclear Structure Data.

The third W.G. has an objective to promote a new Japanese activity on the compilation, evaluation and dissemination of Nuclear Structure and Decay Data (NSDD) in the framework as discussed at the 1976 meeting..

This working group is responsible for:

- Coordination of mass-chain evaluation in Japan;
- Compilation of bibliographic information generated in Japan;
- International exchange of NSDD;
- Utilization of ENSDF for Japanese nuclear data community.

To fulfil these objectives, a manpower of about one man year per year will be devoted by 9 compilers and 8 advisory members on the part-time basis. As in other activities in JNDC, the working group is supported by JAERI Nuclear Data Center (JAERI/NDC) in facilities and additional manpower.

III. Facilities

The JAERI/NDC (its antecedent NDL) has been working last 10 years in the field of neutron data for nuclear energy development. The experiences accumulated and the facilities prepared in these fields will also be applied in the NSDD activities. Computer system consisting of two FACOM 230-75 at JAERI Computing Center is used.

IV. Status of mass-chain evaluation

According to the agreement between JNDC (JAERI NDC) and BNL NNDC, the JNDC will take the responsibility of evaluation of A=118-129 (12 masses) on a 4 year cycle as a long term schedule.

As the first evaluation, data compilation on A=121 has been undertaken since July 1977. At the present, we are devoting our most efforts to establish the evaluation procedures and to familiarize ourselves with the ENSDF system. Refering to the materials sent to us from ORNL Nuclear Data Project, a preliminary compilation was made in ENSDF style to receive the mini-review in the week before this meeting. Also a magnetic tape produced by the JAERI

computer was submitted as a test for data exchange. We hope we could finish the evaluation of A=121 by the end of March 1978. Before making our final result, the evaluated data will be internally refereed by the advisory members in the working group. When the A=121 evaluation is accepted in the ENSDF system, we will begin the evaluation of the next three odd-mass chains A=123, 125 and 127 as one year schedule.

Our three month's experiences in the evaluation can be summarized as follows:

1) References

A complete A-chain reference list of ORNL is very helpful to the collection of related data. Also the reference survey of mass-chain facilitates the up-dating of our reference list. Although important papers were obtained at JAERI library, some specific reports (less than 5 in the case of A=121) were not available.

2) In order to attain to high quality standard in the evaluation and the presentation of data, it is very desirable that the experiences accumulated in the existing centers are introduced. Some of examples are:

- priority in the selection of data,
- treatments of private communication and the papers listed in the Secondary Sources,
- calculation of theoretical values,
- use of computer for evaluation, listing of data, drawing of figures and consistency check.

Experiences of other new groups might also be helpful for resloving these problems and communications in the network on the relevant topics are welcomed.

V. Bibliographic data compilation

Results of nuclear physics experiments produced in Japan are mostly

published in Journal of Physical Society of Japan (keywords inputs are covered by ORNL group) and in foreign journals. Specific nuclear data ($T_{1/2}$, E_γ, I_γ, RI production data) are occasionally published in J. of Nuclear Science and Techonology (English), Radioisotopes (Japanese) and university memoirs. These matters can be included in the ORNL Primary Reference File.

Laboratory reports, mostly circulated within Japan, also contain experimental nuclear data. These data should be included in the Secondary Sources of the file.

The International Conference on Nuclear Structure was held in Japan in September 1977. The proceedings of the contributed papers of this conference have already been issued and the one containing invited talks will be issued in near future.

For the materials which were not covered by the ORNL Reference Group, the Japanese nuclear structure group and reaction group will cooperate to produce keyword inputs.

VI. Horizontal compilation

Most of the compilation and evaluation activities[1] reported in the 1976 meeting have been continued. As a part of new activities in the JNDC, Chart of the Nuclides[2] which contains measured and calculated half-lives and abundance data was published by Y.Yoshizawa, T.Horiguchi and M.Yamada. Another type of compilation[3] made by Z.Matumoto, T.Murata and R.Nakasima concerns with the level properties (i.e. level energies and spin-parities) for the calculation of inelastic neutron scattering cross-sections of important fission products. M.Sakai and A.C.Rester completed 1977 version[4] of continuing efforts of sytematics of quasi-ground, quasi-beta and quasi-gamma

bands. On the Chart of Nuclides from the Nishina Memorial Foundation, A.Hashizume is collecting data for the next edition.

We acknowledge the distribution of the ENSDF magnetic tape by BNL. The evaluation activities mentioned here will be greatly facilitated by the use of the ENSDF resources and the bibliographic information.

VII. Summary

Mass-chain evaluation activity has just started in Japan. We hope that we could finish evaluation on A=121 by the end of March 1978, and continue it on a regular basis of three masses per year. Other data activities within the scope of the present meeting will also be promoted.

References:

1) Summary Report of the 1976 IAEA Advisory Group Meeting on Nuclear Structure and Decay Data for Applications, 3-7 May 1976 Edited by A.Lorenz INDC (NDC)-79/LN p.83

2) Y.Yoshizawa, T.Horiguchi and M.Yamada: Chart of Nuclides, Feb. 1977 Japanese Nuclear Data Committee and Nuclear Data Center JAERI

3) Z.Matumoto, T.Murata and R.Nakasima: Contributed paper to the 2nd Advisory Group Meeting on Fission Product Nuclear Data 1977, Level Scheme for some Fission Product Nuclides, to be published as JAERI M-Report

4) M.Sakai and A.C.Rester: INS Report-290, Table of Members of Quasi-Ground, Quasi-Beta and Quasi-Gamma Bands 1977 37 p

STATUS REPORT

NUCLEAR STRUCTURE DATA EVALUATION IN SWEDEN

B. Erlandsson

In Sweden at the University of Lund we have just started work with A–chain evaluation. As a new member of this project, we have been advised to start with the nuclei A = 113–117 although our main interest and experimental experience are further down in the periodical table.

Evaluation activities are centered at Lund where a post at the University involves about half–time in nuclear data handling. This post is filled by Dr. B. Erlandsson who is assisted by different people from the University of Lund.

The Swedish Nuclear Data Committee has, during the past year, organized a network of contact men so that nuclear data information will penetrate also to the small–scale user.

Status Report on Nuclear Decay Data Evaluation

CNEN (Bologna)

Although there is potential interest of CNEN to contribute to the international effort on nuclear structure and decay data evaluation according to the criteria indicated at the last NSDD meeting, Vienna, 3-6 May 1976, at the present time, due to the high priority set by CNEN all efforts have been concentrated on fission product evaluation. In accordance with this priority programme, and for the purpose of neutron cross section evaluation, the decay schemes of 123 isotopes in the mass region $84 \leq A \leq 160$ have been evaluated.

Activities at the KFA-Jülich on the collection of nuclear data for activation analysis

Gerhard Erdtmann

Our group at the KFA-Jülich is applying the methods of nuclear physics and chemistry to chemical analysis. For many applications we need reliable nuclear data and easy access to them is required. This means they are accessible to computer handling and in tables which are arranged so that they are convenient in the laboratories. As I reported in Vienna we collected all γ-ray data of the radioactive nuclides and prepared them for computer storage. The result has been the Gamdat-File which is available since about four years as a magnetic tape. Excerpts of this record are used in many laboratories to prepare computer stored libraries for automatic γ-spectra evaluation and the identification of radionuclides by γ-ray spectrometry. A printed version of the Gamdat-File was distributed as a report (JÜL-1003-AC). However all copies of this report have been given out meanwhile. A new printing is not advisable because an updated data collection has been completed, which will supersede the present Gamdat-File.

The older version of the Gamdat-File was mainly based on original papers, whereas for the new file about 80 % of the data is based on information taken from the Nuclear Data Sheets. We stopped data input some weeks ago and are presently at the point of debugging the new data sets. We hope that the new file will be available at the beginning of 1978. It is also planned to prepare a new printed version of the data. If there are no unexpected hindrances, this book will come out during 1978.

Another type of data very important for applied nuclear sciences and above all for activation analysis are the reaction cross sections. For our work neutron activation cross sections are often required. There existed a great number of such tabulations but in many cases they were too old, too incomplete or too difficult to survey for practical use. Additionally it was obvious that for many reactions data were not very consistent. Therefore we prepared our own table, which meanwhile has also been printed by a German publishing house. This table contains neutron reaction cross sections for the mostly used neutron energy ranges. These are thermal, epithermal and fast reactor neutrons and the 14-MeV generator neutrons. We have calculated the activities of the reaction products for several irradiation times. Also included is a list of the most prominent γ-rays for each radionuclide produced. They are required to identify these nuclides by γ-ray spectroscopy.

Appendix 17

ZAED-M-13

COMPARISON OF THE INTERNATIONAL NUCLEAR INFORMATION SYSTEM (INIS)

AND RECENT REFERENCES (RR)

2 of 2

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Zent :ation

October 1977

I. Introduction

Before dealing with the subject itself, we should like to make a few general remarks on type, extent and scope of the two information systems mentioned above.

INIS was founded in 1970 with the purpose of announcing the literature of nuclear science and technology. It is a "decentralized" system, the input being done by some 60 countries and international organizations, with headquarters at the International Atomic Energy Agency (IAEA) in Vienna. Member states and organizations contribute the literature published within their own territories. The system contains at the moment 314.000 items which are stored on magnetic tape, with a growth rate of about 60.000 items per year. The file includes the bibliographic data (authors, corporation, title, literature citation, etc.), a classification, an abstract (since 1976), and descriptors. An example is presented in the following:

INIS7705 292111

Evidence for core-coupled states in ^{87}Y from a $^{89}Y(p,t)^{87}Y$ and $^{88}Sr(p,t)^{86}Sr$ comparison.

Oelrich, I.C.; Krien, K.; DelVecchio, F.M.; Naumann, R.A.

(Joseph Henry Laboratories and Frick Chemical Laboratories, Princeton University, Princeton, New Jersey 08540).

Phys. Rev., C.v. 14(2) p. 563-572. (Aug. 1976).

Scope: A34;

(01) ANGULAR DISTRIBUTION; DIFFERENTIAL CROSS SECTIONS; DWBA; ENERGY LEVELS; MEV RANGE 10-100; NUCLEAR STRUCTURE; PARTICLE-CORE COUPLING MODEL; PICKUP REACTIONS; PROTON REACTIONS; SINGLE-PARTICLE MODEL; WEAK-COUPLING MODEL; YTTRIUM 87; YTTRIUM 89 TARGET.

(02) ANGULAR DISTRIBUTION; DIFFERENTIAL CROSS SECTIONS; DWBA; ENERGY LEVELS; MEV RANGE 10-100; NUCLEAR STRUCTURE; PARTICLE-CORE COUPLING MODEL; PICKUP REACTIONS; PROTON REACTIONS; SINGLE-PARTICLE MODEL; STRONTIUM 86; STRONTIUM 88 TARGET; WEAK-COUPLING MODEL.

The $^{89}Y(p,t)^{87}Y$ and $^{88}Sr(p,t)^{86}Sr$ reactions were studied at 42 MeV proton energy, using a quadrupole-dipole-dipole-dipole spectograph. Comparison of excitation energies, (p,t) cross section strengths and angular distribution shapes indicates that basic features of the core-coupling model apply to these nuclei. However, mixing of single particle states with the core-coupled states is evident. The (p,t) cross-section strength summed over the ^{87}Y multiplet is found with few exceptions to be nearly a constant multiple of the (p,t) strength of the associated ^{86}Sr state.

Items are retrieved by constructing logical sentences by combining the descriptors (and/or classification) according to the rules of Boolean algebra. A printed version (Atomindex) is published by the IAEA semimonthly. In order to be able to make a comparison of the two systems on the same level, we like to quote the number of items pertaining specifically to nuclear physics (A33 and A34):

38.600 items with a growth rate of 6.900 items per year.

Recent References is the product of the Nuclear Data Project at Oak Ridge National Laboratory (ORNL) and is restricted to the nuclear physics literature only. The Nuclear Data Project was established in 1948 in order to collect and evaluate experimental data on nuclear structure and decay properties. In contrast to INIS, Recent References is a centralized system with the input being done at Oak Ridge. It is believed that the bibliographic file is complete from 1960 onwards. It contains some 80.000 items. Key-word indexing is complete since 1969 for some 54.000 items. The growth rate is about 5.000 items per year. The file contains the bibliographic data (author, title, journal), key number, and keyword abstract. Items can be retrieved by keywords used within the keyword abstract, mainly isotopes, reaction type, and decay type.

A printed version of the file is published regularly in Nuclear Data Sheets. An example is presented in the following:

KEYNO	KEYWORD ABSTRACT	CITATION
760e02 56345	NUCLEAR REACTIONS ^{88}Sr, $^{89}Y(p,t)$, E=42 MeV; measured $\sigma(Et,\theta)$. ^{86}Sr, ^{87}Y deduced levels, J,π,L. Core-Coupling model. Enriched targets. PRVCA C14 563	I.C.Oelrich, K.Krien, R.M. DelVecchio, R.A.Naumann-Phys.Rev. C14, 563 (1976). Evidence for Core-Coupled States in ^{87}Y from a $^{87}Y(p,t)^{87}Y$ and $^{88}Sr(p,t)^{86}Sr$ Comparison.

II. Method and Results

The comparison was carried out from the point of view of the user. The query formulations for INIS were made by us, those for Recent References were supplied by the Nuclear Data Group at Oak Ridge. The items to be retrieved were to refer to all nuclear structure information for the mass chains A = 27 and A = 86. In this study we have considered articles published in journals, conference abstracts and proceedings, reports, and theses, but not unpublished material like preprints.

For the mass chain A = 27, the comparison was made for the 1975 year of publication. The results are listed in table 1.
A more careful appraisal was made of the mass chain A = 86 in order to elucidate certain unconformities noted in the two systems. The claim by the Nuclear Data Group at Oak Ridge that Recent References is complete with regard to publications in regular journals has been substantiated to a large degree. INIS supplied about 50% of all literature citations in regular journals. With regard to so-called secondary sources, i.e. conferences, theses, and reports, the situation was not so unfavourable for INIS. However, it should be pointed out, that the number of secondary items common for both systems is very small.

In view of the relatively poor performance of INIS it is obviously important to discover why certain items could not be extracted from the system. For this purpose, the Atomindex was carefully scanned. Apart from items which are absent from the INIS file, the main reason why information could not be retrieved was that indexing was done too broadly, i.e. when a study encompassed a range of nuclei, often the individual isotopes were not given

but a general descriptor like "light nuclei". In order to eliminate this problem we would strongly suggest that element names be replaced by chemical symbols (for example U238 instead of URANIUM 238). This would reduce the work load in writing down the descriptors for the indexer, surely one of the main reasons for insufficient indexing in these cases.

Table 2 is equivalent to table 1 and refers to the mass chain A = 86, but refers to the period 1973 to 1977. A proper comparison cannot be made between INIS and RR for the years 1970 - 1972 since the full nuclear physics subject scope only became effective for INIS after 1972.

Table 3 presents the situation according to the years of publication.

Not all the publications given in table 2 and 3 are relevant to nuclear structure work (although they contain information on the mass cahin A = 86, such as cross sections, or were used as targets). Table 4 thus contains only the literature information relevant to nuclear structure.

Table 5 presents on the one hand all items which are contained in INIS but which could not be retrieved because of inadequate indexing, and on the other those items which are missing altogether in the system, and in addition those publications in INIS which are not contained in the RR output listings.

Table 6 is equivalent to table 5 but pertains to relevant publications only. In connection with table 6 it ought to be pointed out that as a general policy secondary references are deleted from the RR file as soon as an article is published in a regular journal. In the appendix a list of the references mentioned in tables 5 and 6 is presented explicitely.

It should also be mentioned that national conferences and theses are often only covered by one of the two information systems. Examples are: Bulletin of the American Physical Society which is in RR but not in INIS, and "Frühjahrstagung" of the Deutsche Physikalische Gesellschaft which is only contained in INIS.

We would like to acknowledge the assistance of Dr. B. Jenschke, Mrs. U. Schulze and Mrs. G. Suhrcke in obtaining some relevant material.

Table 1

Comparison INIS vs. RR for Mass A = 27: Number of items retrieved for 1975 year of publication

Published as:	RR	INIS	Intersection	True total
(1) Journal article	106	59	48	117
(2) Report	31	16	4	43
(3) Conference abstract or proceedings	23	30	2	51
(4) Thesis	9	8	2	15
Grand total	169	113	56	226
(A) Journals	106 (90.6%)*	59 (50.4%)	48 (41.0%)	117 (100%)
(B) Others	63 (57.8%)	54 (49.5%)	8 (7.3%)	109 (100%)

*In brackets values expressed as percentage of true total

Table 2

Comparison INIS vs. RR for Mass A = 86: Number of items retrieved for period 1973 - July 1977

Published as:	RR	INIS	Intersection	True total
(1) Journal article	74	40	38	76
(2) Report	29	6	4	31
(3) Conference abstract* or proceedings	23	7	3	27
(4) Thesis	2	2	1	3
Grand total	128	55	46	137
(A) Journals	74 (97.4%)	40 (52.6%)	38 (50.0%)	76 (100%)
(B) Others	54 (88.5%)	15 (24.6%)	8 (13.1%)	61 (100%)

*The RR file contains 12 Bull. Am. Phys. Soc. abstracts which are not indexed by INIS.

Table 3

Comparison INIS vs. RR for Mass A = 86: Number of items retrieved per year of publication 1970 - July 1977*

(A) Journals

	1970	1971	1972	1973	1974	1975	1976	1977
Recent Refs	17	17	21	21	13	24	12	4
	(94)	(100)	(91)	(100)	(100)	(100)	(86)	(100)
INIS	1	1	9	13	6	12	8	1
	(6)	(6)	(39)	(62)	(46)	(50)	(57)	(25)

(B) Reports, Conferences, Theses

	1970	1971	1972	1973	1974	1975	1976	1977
Recent Refs.	13	14	27	23	14	5	9	3
	(93)	(100)	(90)	(96)	(82)	(83)	(82)	(100)
INIS	2	1	6	4	6	3	2	0
	(14)	(7)	(20)	(17)	(35)	(50)	(18)	(0)

*In brackets percentage values. For totals see Table 2.

Table 4

Comparison INIS vs. RR for Mass A = 86: Number of relevant items retrieved per year of publication*

(A) Journals

	1970	1971	1972	1973	1974	1975	1976	1977
Recent Refs.	12	9	14	13	9	16	7	3
	(100)	(100)	(93)	(100)	(100)	(100)	(100)	(100)
INIS	0	0	7	8	4	8	2	1
	(0)	(0)	(47)	(62)	(44)	(50)	(29)	(33)

(B) Reports, Conferences, Theses

	1970	1971	1972	1973	1974	1975	1976	1977
Recent Refs.	10	11	19	13	8	1	5	2
	(100)	(100)	(90)	(93)	(80)	(50)	(100)	(100)
INIS	1	1	4	4	4	2	0	0
	(10)	(9)	(19)	(29)	(40)	(100)	0	0

*In brackets percentages of true relevant total.

Table 5

Comparison INIS vs. RR for Mass A = 86:
A lists the number of items missing in INIS/Atomindex.
B lists the number of items contained in INIS but not retrieved for various reasons.
C gives the number of items contained in INIS but not in the RR output listings.
For detailed lists regarding A, B, and C see appendix.

Category		1970	1971	1972	1973	1974	1975	1976	1977	Total
A	Journals	4	6	4	3	1	1	1	3	23
	Others	10	11	18	15	6	1	8	3	72
B		0	0	2	6	5	9	6	0	28
C		2	0	5	1	3	1	4	0	16

Table 6

Comparison INIS vs. RR for Mass A = 86: Identical to Table 5 but selected for relevance to nuclear structure work.

Category		1970	1971	1972	1973	1974	1975	1976	1977	Total
A	Journals	4	4	3	1	1	1	1	2	17
	Others	8	10	16	7	3	0	4	2	50
B		0	0	1	3	5	4	5	0	18
C		0	0	3	1	2	1	0	0	7

Appendices

The lists presented under A, B, and C contain the following information (from left to right):
Author key number (see RR), residual nucleus, target nucleus, reaction type, source of citation and type of publication.
Abbreviations used are:

PUB:	Published in journals
CONF:	Conference abstract or proceedings
REP:	Report
THES:	Thesis
BAPS:	Bull. Am. Phys. Soc.
RR:	Recent References
IN:	INIS
NA:	Reference not in INIS
NR:	Reference not in INIS but report as such
AB, AI, AW:	Reference in INIS but not retrieved because of broad indexing (AB), specific mass 86 isotope not indexed (AI), or indexing error (e.g. residual nucleus in a reaction not mentioned) (AW).

Appendix A1

References not in INIS

70AB08	86RB	86RB	DECAY	NA RR	PUB
70DE20	86RB		DECAY	NA RR	PUB
70KE20	86SR	89Y	(M,XG)	NA RR	PUB
70K020	86RB		DECAY	NA RR	PUB
71FR17	86RB		SIGMA	NA RR	PUB
71KI16	86SR		THEORY	NA RR	PUB
71MA43	86RB		DECAY	NA RR	PUB
71ME13	86KR		ABUND	NA RR	PUB
71RE18	86SR	86Y	DECAY	NA RR	PUB
71RU15	86RB	87RB	(N,2N) 15	NA RR	PUB
72BA75	86SR	88SR	(P,T) 31	NA RR	PUB
72C021	86KR	86KR	(P,P)	NA RR	PUB
72EJ01	86RB		DECAY	NA RR	PUB
72F013	86RB	87RB	(3HE,A) 16	NA RR	PUB
73MU09	87SR	86SR	(N,G)	NA RR	PUB
73PE10	87SR	86SR	(N,G)	NA RR	PUB
73VD02	86KR		THEORY	NA RR	PUB
74AP02	86RB		DECAY	NA RR	PUB
75LAYR	86Y	86ZR	DECAY	NA RR	PUB
76KIZK	86SE		DECAY	NA RR	PUB
77JE03	87KR	86KR	(N,G)	NA RR	PUB
77KI06	86SR	86SR	(P,P'G)	NA RR	PUB
77K005	86NB		HI	NA RR	PUB

Appendix A2

References not in INIS

70BEYG	86SR	86SR	(G,G')	9	NR RR	REP
70ERZZ	86BR		DECAY		NA RR	THES
70MAZF	87Y	86SR	(3HE,D)		NA RR	BAPS
70MAZG	86SR	86RB	DECAY		NA RR	CONF
70MAZR	85BR	86KR	(D,3HE)		NA RR	REP
70MAZY	85BR	86KR	(D,3HE)	40	NA RR	BAPS
70PEZU	86RB	85RB	(N,G)		NA RR	REP
70SIZO	86RB		DECAY		NA RR	REP
70SMZY	86RB		DECAY		NA RR	THES
70WIZS	86RB		DECAY		NA RR	CONF
71BAXM	86RB		T1/2		NA RR	REP
71BJZZ	86KR	86KR	(P,P')		NA RR	BAPS
71CUZZ	86SR	86SR	(P,P')		NA RR	BAPS
71DAZX	85SR	86SR	(P,D)	21	NA RR	BAPS
71FOZO	86SR	86SR	(P,P')	12	NA RR	REP
71HOYA	86KR	86KR	(P,P')		NA RR	REP
71HOZV	86KR	86KR	(P,P')	10	NA RR	BAPS
71ISZQ	86SR	87RB	(P,2NG)	52	NA RR	REP
71ISZU	86SR		G-DECAY		NA RR	REP
71KIZN	85Y	86SR	(P,2N)		NA RR	CONF
71TAZU	86KR	86BR	DECAY		NA RR	BAPS
72AMZY	87Y	86SR	(P,G)		NA RR	BAPS
72BOYY	86SR		SIGMA		NA RR	REP
72HAWU	86SR	88SR	(P,P2NG)		NA RR	CONF
72HEYQ	89Y	86SR	(A,P)		NA RR	REP
72HOXZ	86KR	86KR	(P,P')		NR RR	REP
72HOZO	86RB	87RB	(D,T)	18	NA RR	BAPS
72KOZU	86RB	88SR	(D,A)	17	NA RR	BAPS
72KRZI	86AS		DECAY		NA RR	REP
72KRZJ	86AS		T1/2		NA RR	REP
72MAWS	86SR	84KR	(A,2NG)		NA RR	REP
72MAZY	84KR	86KR	(P,T)	26	NA RR	BAPS
72MIZS	86SR	88SR	(P,P2N)		NA RR	REP
72NEZR	86KR	87RB	(D,3HE)	29	NA RR	REP
72NOZZ	86RB	87SR	(D,3HE)	28	NA RR	BAPS
72RAYZ	85RB	86SR	(T,A)		NA RR	BAPS
72RAZO	86SR	86SR	(P,P')		NA RR	BAPS
72TUZZ	86KR	87RB	(T,A)	15	NA RR	BAPS
72VAZP	87SR	86SR	(N,G)		NA RR	CONF
73ARYR	89SR	86KR	(A,NG)		NA RR	REP
73ARZI	86SR		(N,2N)		NR RR	REP
73BEXV	86SR	86Y	DECAY		NA RR	CONF
73BEZB	86RB		DECAY		NR RR	REP
73COZF	86SR	89Y	(P,A)		NA RR	BAPS
73DEZA	87KR	86KR	(D,P)		NA RR	REP
73FAZY	87SR	86SR	(N,G)		NA RR	REP

73HAVV	86SR	88SR	(P,P2NG)		NA RR	CONF
73HAWW	86SR	84KR	(A,2NG)	22	NA RR	REP
73HUZA	86RB		DECAY		NA RR	REP
73NOYZ	87Y	86SR	(P,G)		NR RR	REP
73OLZP	86KR	84KR	(T,P)		NA RR	REP
73PIZW	96RU	86SR	(16O,X)		NA RR	BAPS
73PIZZ	98PD	86SR	(16O,4N)		NA RR	BAPS
73VAZR	87SR	86SR	(N,G)		NR RR	REP
74BRZT	86SR	85RB	(3HE,D)	33	NA RR	BAPS
74EAZX	85SR	86SR	(N,2N)		NA RR	THES
74HEZC	87RB	86KR	(3HE,D)		NA RR	BAPS
74POZS	86ZR	84SR	(A,2NG)		NA RR	REP
74RIZV	86KR	84KR	(T,P)		NA RR	BAPS
74SLZY	86SR	86SR	(P,P)		NA RR	BAPS
75HOZR	87Y	86SR	(D,N)		NA RR	REP
76ALYV	86BR		DECAY		NR RR	REP
76ALZE	88SR	86KR	(3HE,N)		NA RR	BAPS
76ARZJ	87ZR	86SR	(A,3NG)		NA RR	REP
76JEZZ	87KR	86KR	(N,G)		NA RR	BAPS
76NAYU	86SR	88SR	(P,T)		NA RR	REP
76NIZZ	86AS		DECAY		NR RR	REP
76PIZM	87Y	86SR	(P,G)		NA RR	CONF
76SEZV	86SR	88SR	(P,T)		NA RR	BAPS
77ALZL	86BR		Q		NA RR	REP
77BAZR	86ZR		(A,XNG)		NA RR	BAPS
77RAZZ	90ZR	86SR	(A,G)		NA RR	BAPS

Appendix B

References in INIS, but not retrieved for various reasons.

72HI13	86BR		DECAY	AB RR	CONF
72OGZW	86SR		THEORY	AI RR	REP
73CH10	86SR		HI	AB RR	PUB
73ENO1	86ZR		SIGMA	AB RR	PUB
73JEZS	86SR		SIGMA	AB RR	REP
73LAYG	86KR		SIGMA	AB RR	REP
73OGZX	86SR		THEORY	AI RR	CONF
73SA28	86KR		THEORY	AB RR	PUB
74GR29	86BR		T1/2	AB RR	PUB
74JOZG	86BR		DECAY	AB RR	REP
74KRZG	86AS		T1/2	AI RR	CONF
74KR16	86SR		THEORY	AB RR	PUB
74SH18	86KR	87BR	DECAY	AW RR	PUB
75AL11	86BR		DECAY	AB RR	PUB
75AN10	86SR		THEORY	AB RR	PUB
75EMO2	86RB		DECAY	AB RR	PUB
75FU11	86RB		MOMENT	AB RR	PUB
75IZ03	86AS		THEORY	AB RR	PUB
75KO01	86BR		DECAY	AB RR	PUB
75PO12	85SR	86SR	(3HE,AG)	AW RR	PUB
75SO06	86KR		THEORY	AB RR	PUB
75STO5	90ZR	86SR	(6LI,D)	AB RR	PUB
76GH01	86ZR		THEORY	AI RR	PUB
76GI03	86KR		THEORY	AB RR	PUB
76GRO7	86SR		THEORY	AB RR	PUB
76JE02	87KR	86KR	(N,G)	AB RR	PUB
76ST11	86SR	90ZR	(3HE,7BE)	AB RR	PUB
76VDZZ	86SR		THEORY	AI RR	CONF

Appendix C

References not in RR

70DUNA	86RB	85RB	SIGMA	NS,IN	PUB
70LANA	86RB	85RB	SIGMA	IN	CONF
72DMNA	86RB		SIGMA	NS,IN	PUB
72FRNA	86AS		DECAY	IN	CONF
72KRNA	86BR		DECAY	IK,IN	THES
72LANA	86RB		SIGMA	IN	THES
72MANB	86RB		DECAY	IN	PUB
73VONA	86NB	87NB	DECAY	IN	CONF
74ARNA	86KR	86KR	(P,P')	IN,NS	THES
74BRNA	86SR	85RB	(3HE,D) 33	IN,NS	REP
74PRNA	86KR	86KR	SIGMA	IN	REP
75HINA	86ZR	76SE	(12C,2N)	IN,IK	CONF
76BRNA	86KR		BEAM	IN	CONF
76MONB	86KR		BEAM	IN	CONF
76QANA	86RB		SIGMA	IN	PUB
76WA06	86KR		BEAM	IN	PUB

Appendix D

List of References

70AB08 S.M. Abecasis, F. Krmpotic - Nucl. Phys. A151, 641(1970); Erratum Nucl. Phys. A166, 675(1971) \
70BEYG G. Ben-David et al. - IA--1218, p. 24-25 (1970) \
70DE20 A. de Beer, H.P. Blok, J. Blok - Nucl.Instr.Meth.. 78,19 (1970) \
70DUNA Dudey, N.D.; Heinrich, R.R.; Madson, A.A. J. Nucl. Energy v. 24(4)p. 181-189 \
70ERZZ H.N. Erten - Thesis MIT, Cambridge (1970) \
70KE20 D. Kessler, R.J. McKee, C.K. Hargrove, E.P. Hincks, H.L. Anderson - Can.J.Phys. 48, 3029 (1970) \
70KO20 I.V. Kopytin, I.S. Batkin - Yad.Fiz. 11, 342 (1970); Sov.J.Nucl.Phys. 11, 192 (1970) \
70LANA Lakshmana Rao, A.; Parthasaradhi, K.; Rama Rao, J. Proc. of the Nucl. Phys. and Solid State Phys. Sym., Madurai, India. (Dec 1970) Vol. 2. Nuclear Phys. p. 19-23 (1971) \
70MAZF J.V. Maher - Bull.Am.Phys.Soc 15, 551 (1977) \
70MAZG J.C. Manthuruthil - Conf Delft (Ang.Corr.), p. 311 (1970) \
70MAZR E.C. May, S.A. Lewis - UCP-CNL--125, p. 23 (1971) \
70MAZY E.C. May, S.A. Lewis - Bull.Am.Phys.Soc. 15, 550 (1970) \
70PEZU G.Y. Petit - LYCEN--7034, p. 117 (1970) \
70SIZO P.C. Simms - COO--1746-44 (1970)
70SMZY H.A. Smith - Thesis, Purdue Univ (1970) \
70WIZS R. Wischhusen - Conf Delft (Ang.Corr.), p. 315 (1970) \
71BAXM S. Baba - JAERI--1211 (1971) \
71BJZZ C.W. Bjork - Bull.Am.Phys.Soc. 16, 1169 (1971) \
71CUZZ N. Cue - Bull.Am.Phys.Soc. 16, 1159 (1971) \
71DAZX W. Darcey et al. - Bull.Am.Phys.Soc. 16, 627 (1971) \
71FOZO J.L.C. Ford et al. - ORNL--4659, p. 53 (1971) \
71FR17 E.M. Franz, G. Friedlander - Phys.Rev. C4, 1671 (1971) \
71HOYA C.L. Hollas - ORO--2972-204, p. 28-33 (1971) \
71HOZV C.L. Hollas et al. - Bull.Am.Phys.Soc. 16, 557 (1971) \
71ISZO M. Ishihara et al. - NP--19155, p. 45 (1971) \
71ISZU M. Ishihara - (Inst. f. Nucl.Study, Tokyo) INSJ Annual Rept 1970, p. 48 \
71KIZN R.L. Kiefer - 162nd ACS Natl. Meeting, abstract 28 (1971) \
71KI16 J.E. Kitching et al. - Nucl.Phys. A177, 433 (1971) \
71MA43 J.C. Manthuruthil et al. - Phys.Rev. C4, 960 (1971) \
71ME13 C.E. Melton et al. - Z.Naturforsch. 26a, 1241 (1971) \
71RE18 A.C. Rester - Nucl.Instr.Meth. 96, 269 (1971) \
71RU15 E. Rurarz et al. - Acta Phys.Pol. B2, 553 (1971) \
71TAZU W.L. Talbert Jr. et al. - Bull.Am.Phys.Soc. 16, 1169 (1971)
72AMZY J.F. Amann - Bull.Am.Phys.Soc. 17, 446 (1972) \
72BA75 J.B. Ball, J.S. Larsen - Phys.Rev.Lett. 29, 1014 (1972) \
72BOYY M. Bormann et al. - EANDC(E)--150-U(suppl.), p. 30 (1972) \
72CO21 W.R. Coker et al. - Phys.Lett. 40B, 164 (1972) \
72DMNA P.P. Dmitriev et al. - At.Energ.(USSR) 32, no.5, 426-428 (1972) \
72EJ01 H. Ejiri - Nucl.Phys. A178, 350 (1972) \
72FO13 C.M. Fou - Nucl.Phys. A192, 139 (1972) \
72FRNA Franz, H.; Herrmann, G.; Kratz, J.V.; Kratz, K.L. J. Phys. (Paris), Colloq. (no.5) p. 31 (1972) \
72HAWU O. Hashimoto et al. - Proc.Int.Conf. on Nucl.Moments and Nucl. Structure, Osaka (1972) \

/2HEYQ W. Henning et al. - TU Muenchen Jahresbericht p. 88 (1972) \
72HI13 J.C. Hill - Trans.Amer.Nucl.Soc. 15, suppl.no.1, 2 (1972) \
/2HOXZ C.L. Hollas et al. - ORO--2972-226(task1), p. 22 (1972) \
72HOZO J.E. Holden - Bull.Am.Phys.Soc. 17, 444 (1972) \
/2KOZU J. Kolata - Bull.Am.Phys.Soc. 17, 445 (1972) \
/2KRNA Kratz, K.L. Thesis (Mainz Univ. (F.R. Germany). Naturwissenschaftliche Fakultaet) 355 p. (Jul 1972) \
72KRZI J.V. Kratz - BMBW-FBK--72-15, p. 32 (1972) \
72KRZJ J.V. Kratz, H. Franz - BMBW-FBK--72-15, p. 27 (1972) \
/2LANA Lagarde, M. Thesis (Bordeaux-1 Univ., 33 (France)) 183 p. (1972) \
72MANB Mantel, J. Int. J. Appl. Radiat. Isot. v. 23(9) p. 407-413 (1972) \
72MAWS E. Matthias et al. - UTPN--1 (Tokyo Univ., Nuclear Phys. Group) p. 43 (1972) \
72MAZY E.C. May - Bull.Am.Phys.Soc. 17, 50 (1972)
/2MIZS K. Miyano - (Inst. f. Nucl. Study, Tokyo) INSJ Annual Rept. 1971, p. 35 \
/2NEZR G. Neff, W.S. Gray - COO--2167-1, p. 12 (1972) \
72NOZZ M. Noble - Bull.Am.Phys.Soc. 17, 72 (1972) \
/2OGZW K. Ogawa - JAERI--1221, p. 141 (1972) \
/2RAYZ R. Ragaini - Bull.Am.Phys.Soc. 17, 909 (1972) \
72RAZO A.V. Ramayya - Bull.Am.Phys.Soc. 17, 445 (1972) \
72TUZZ A.B. Tucker - Bull.Am.Phys.Soc. 17, 50 (1972) \
/2VAZP G. Vanpraet - Conf. on Nucl. Structure Study with Neutrons Budapest. Contributions, p. 208 (1972) \
73ARYR S.E. Arnell et al. - Res.Inst.Phys. Stockholm Ann.Rep., p. 92 (1973) \
/3ARZI J. Araminowicz, J. Dresler - INR-1464, p.14 (1973) \
/3BEXV R.B. Berzhanov et al. - Yadernoj spectroscopii i structure atomnogo yadra. 23. soveshchaniya, Tbilisi. Programma i tezis y dokladov, p. 48 (1973) \
73BEZB H. Behrens - KFK--1780, p. 40 (1973) \
/3CH1O P.R.Christensen et al. - Nucl.Phys. A207, 33 (1973) \
/3COZF J.R. Comfort - Bull.Am.Phys.Soc. 18, 721 (1973)
/3DEZA Univ. Notre Dame Annual Rept. 1973, p. 36 \
/3ENO1 G. English et al. - Phys.Rev.Lett. 31, 244 (1973) \
73FAZY U. Fanger et al. - EANDC(E)--157-U, p. 18 (1973) \
/3HAVV O. Hashimoto - Proc.Int.Conf. on Nucl.Moments and Nucl. Structure, Osaka, p. 259 (1972) \
73HAWW O. Hashimoto et al. - IPCR-Cyclotron Progress Report. Vol. 6, p. 84 (1972) \
/3HUZA R.G.Hughes, R.G. Helmer - ANCR--1129, p. 77 (1973) \
/3JEZS L. Jeki - KFKI--71-8 (1973) \
/3LAYG G, Lautenbach - RCN--191 (1973) \
/3MUO9 M.S. Murty et al. - J.Phys.Soc.Jap. 35, 8 (1973) \
73NOYZ H.P. Nottrodt, F. Rauch - IKF-32 (Inst. f. Kernphys. Frankfurt - Jahresbericht), p. 17 (1973) \
/3OGZX K. Ogawa - Proceedings of the Int. Conf. on Nucl. Phys, Munich. Contributed Papers. Vol. 1, p. 89 (1973) \
/3OLZP D.K. Olsen - ORO--2972-245, p.66 (1973) \
73PE1O G. Peto et al. - Acta Phys. 33, 363 (1973) \
73PIZW W.F. Piel et al. - Bull.Am.Phys.Soc. 18, 702 (1973)

73PIZZ W.F. Piel et al. - Bull.Am.Phys.Soc. 18, 702 (1973) \
73SA28 M. Sakai - Phys.Lett. 46B, 167 (1973) \
73VAZR G.J. Vanpraet et al. - ORNL--4844, p. 57 (1973) \
73VD02 A.I. Vdovin, C. Stoyanov - Izv.Akad.Nauk SSSR, Ser.Fiz. 37, 1750 (1973); Bull.Acad.Sci.USSR, Phys.Ser. 37, no.8, 162 (1974) \
73VONA Votsilka, I. et al., Conf. on Nucl. Spectr. and Nucl. Struct. Tbilisi, Jan 1973; Izv. Akad. Nauk SSSR, Ser. Fiz. v. 38(1) p. 57-62 (Jan 1974) \
74AP02 H. Appel et al. - Z.Phys. 268, 347 (1974) \
74ARNA Arora, B.K. Thesis (Texas Univ., Austin (USA)University Microfilms Order-No. 75/4316 \
74BRNA Brabeck, P.G.; Schneider, M.J.; Anderson, R.E. COO--535-710 p. 31-33 (Nov 1974) \
74BRZT P.G. Brabeck et al. - Bull.Am.Phys.Soc. 19, 450 (1974) \
74EAZX P.K. Eapen - Thesis, Southern Methodist Univ. (1973) \
74GR29 B. Grapengiesser et al. - J.Inorg.Nucl.Chem. 36, 2409 (1974) \
74HEZC S.C. Haedley et al. - Bull.Am.Phys.Soc. 19, 1002 (1974) \
74JOZG K.A. Johansson et al. - LF--58 (1974) \
74KRZG J.V. Kratz, G. Herrmann - Conf Phys. and Chem. of Fission, Rochester Vol. 2, p. 95 (1974)
74KR16 K.S. Krane - Phys.Rev. C10, 1197 (1974) \
74POZS W.L. Posthumus et al. - Inst. v. Kernphysisch Onderzoek, Amsterdam, Progr., IKO-73/74, p. 21 (1974) \
74PRNA Prince,A. BNL-NCS-50503. ENDF-232. 57p., Aug. 1974 \
74RIZV P.J. Riley et al. - Bull.Am.Phys.Soc. 19, 450 (1974) \
74SH18 S. Shalev, G. Rudstam - Nucl.Phys. A230, 153 (1974) \
74SLZY D.C. Slater - Bull.Am.Phys.Soc. 19, 450 (1974) \
75AL11 K. Aleklett et al. - Nucl.Phys. A246, 425 (1975) \
75AN10 G.S. Anagnostatos - Nucl.Phys. A246, 445 (1975) \
75EM02 B. Eman et al. - Z.Phys. A273, 89 (1975) \
75FU11 T. Fujita, A. Arima - Nucl.Phys. A254, 513 (1975) \
75HINA Hick, H.; Kaba, M.; Korschinek, G.; Kutschera, W.; Miyano, K.; Morinaga, H.; Nolte, E.; Vogt, P.; Walter, T. Verh. Dtsch. Phys. Ges. v. 10(7) p. 775 (1975) \
75HOZR J. Horton - USNDC Status Rept. (U.S. Army, B) 1975 \
75IZ03 T. Izak-Biran, S. Amiel - Nucl.Sci.Eng. 57, 117 (1975) \
75KO01 T. Kodama, K. Takahashi - Nucl.Phys. A239, 489 (1975)
75LAYR V. Lakshminarayana et al. - Proc. Nucl.Phys. and Solid State Phys. Symp., vol. 18B, p. 243 (1975) \
75PO12 D. Popescu - Stud.Cercet.Fiz. 27, 239 (1975) \
75SO06 P.C. Sood, D.C. Agrawal - Phys.Rev. C11, 2056 (1975) \
75ST05 U. Strohbusch et al. - Phys.Rev.Lett. 34, 968 (1975) \
76ALYV K. Aleklett et al. - CERN--76-13, p. 113 (1976) \
76ALZE W.P. Alford et al. - Bull.Am.Phys.Soc. 21, 1009 (1976) \
76ARZJ S.E. Arnell et al. - Research Inst. Phys., Stockholm Annual Rept., p. 76 (1976) \
76BRNA Britt,H.C. et al., Symp. on Macroscopic Features of H.I. Collisions.Argonne, Ill.(USA) 1 Apr 1976. LA-UR--76-732; CONF--760 42-1, 11p.(1976) \
76GH01 M.K. Gosh et al. - Can.J.Phys. 54, 663 (1976) \
76GI03 V. Gillet et al. - J.Phys.(Paris) 37, 189 (1976) \
76GR07 R. Gross, A. Frenkel - Nucl.Phys. A267, 85 (1976) \
76JEZZ C.M. Jensen - Bull.Am.Phys.Soc. 21, 84 (1976) \
76JE02 C.M. Jensen et al. - Nucl.Instrum.Meth. 135, 21 (1976)

76KIZK Kiso - Ann. Rep. Res. Reaktor Inst., Kyoto Univ. vol. 9, p. 117 (1976) \
76MONB Moretto, L.G.; Sventek, J.S. Proc. of the Symp. on Macroscopic Features of Heavy-Ion Coll. Vol. 1. Invited Papers. ANL-PHY--76-2(vol.1) p. 235-294 (May 1976) \
76NAYU Nann - MSUCL--74/76 Annual Rept. (Mich.State Univ.), p. 38 (1976) \
76NIZZ Y. Nir-El, S. Amiel - CERN--76-13, p. 322 \
76PIZM J. Piotrowski et al. - Conf. Select. Topics in Nucl. Struct., Dubna. Vol. 1, p. 55 (1976) \
76QANA S.M. Qaim, G. Stoecklin - Nucl.Phys. 257, p. 233 (1976) \
76SEZV K.K. Seth - Bull.Am.Phys.Soc. 21, 607 (1976) \
76ST11 W.F. Steele et al. - Nucl.Phys. A266, 424 (1976) \
76VDZZ Space Activity Impact on Science and Technology. Symp. at 24th Int. Astronaut. Congr., Baku (USSR). Proc. p. 312 (1976) \
76WA06 D. Ward et al. - Nucl.Phys. A266, 194 (1976) \
77ALZL Aleklett - INDC(SWD)--10/U, p. 37 (1977) \
77BAZR Batay-Csorba - Bull.Am.Phys.Soc. 22, 566 (1977) \
77JE03 C.M. Jensen et al. - Phys.Rev. C15, 1972 (1977) \
77KI06 H.T. King, D.C. Slater - Nucl.Phys. A283, 365 (1977) \
77KO05 G. Korschinek - Z.Phys. A281, 409 (1977)
77RAZZ K. Raghunathan et al. - Bull.Am.Phys.Soc. 22, 542 (1977)

Letter to Editors of Physics Journals

A. Lorenz

In accordance with action # 2 of the May 1976 Nuclear Structure and Decay Data Meeting, IAEA/NDS in cooperation with the US Nuclear Data Project, has sent the attached letter to the Editors of the scientific journals listed below, requesting the adoption of the Recent References keyword system.

The letter has been sent to the editors of 24 journals which contain the majority of nuclear spectroscopy reports, they are:

Acta Physica Polonica
Atomki Koezlemenyek
Bulletin of the American Physical Society
Canadian Journal of Physics
Czechoslovak Journal of Physics
Fizika Elementarnykh Chastits i Atommogo Yadra
Helvetica Physica Acta
Indian Journal of Physics
Izvestiya AN SSSR, Seriya Fizicheskaya
Journal of Inorganic and Nuclear Chemistry
Le Journal de Physique
Journal of Physics G: Nuclear Physics
Journal of the Physical Society of Japan
Il Nuovo Cimento
Physica
Physica Scripta
Physical Review Letters
Physics Letters B
Radio Chimica Acta
Revue Roumaine de Physique
Yadernaya Fizika
Zeitschrift fuer Physik A

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

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

TELEPHONE 52 45 11
52 45 25
TELEX 1-2645
CABLE INATOM VIENNA

IN REPLY PLEASE REFER TO
PRIERE DE RAPPELER LA RÉFÉRENCE

21 October 1977

Sir,

In May 1976, the IAEA convened an Advisory Group of nuclear physicists representing the major centers of evaluation of nuclear structure and decay data. In context of its primary objective to establish a common international system for the compilation, evaluation, exchange and dissemination of these data, the meeting strongly recommended

- that the keyword system developed and used since 1964 by the Nuclear Data Project (NDP) at the Oak Ridge National Laboratory (USA) for the description of nuclear physics articles, and in current use by the journals Nuclear Physics, the Physical Review C, and Nuclear Data Sheets, should be used by scientific journals which publish such articles;
- that the keyword abstracts prepared by authors for this purpose undergo the same review procedures as any other part of the article, and be published in the journal together with the article; and
- that insofar as practical, galley proofs of each nuclear physics article accepted for publication be sent to the Nuclear Data Project where the keyword abstract could be proofread or verified before publication.

The extended use of the NDP system of author-supplied keyword abstracts would be a great help in the development of an effective international system for compilation and evaluation of nuclear physics data. Since its introduction in 1964, the keyword system has gained wide acceptance by the nuclear physics community. At a time when many disciplines are just beginning to face the problem of detailed indexing of data in the scientific literature, nuclear physicists enjoy the existence of a functioning, dynamic indexing system and would benefit from a further extension of its use.

Accept, Sir, the assurances of my highest consideration.

H. Kakihana

H. Kakihana
Deputy Director General
Department of Research
and Isotopes

COMMENTS ON THE EVALUATION REPORT INDC(CCP)-75/LN

W. B. Ewbank, N. E. Holden, C. M. Lederer

In INDC(CCP) report, the authors describe procedures which can be computerized to statistically analyze data. Although the authors do mention the analysis of the measurement method and the uncertainty for particular experiments, the report essentially deals with the statistical treatment of data and uncertainties.

We agree with the use of weighted averages where appropriate. An average may also help decide which of several discrepant input values is more likely to be in error, but one should never recalculate the uncertainty of a data value on the basis of its agreement or disagreement with other measurements.

We believe that the essence of a nuclear data evaluator's task is critical evaluation rather than statistical analysis. His (or her) most important skills include:

1. The ability to judge the results of a given experimental technique as used in actual experiments. (The evaluator must be quick to understand the importance of improved techniques, as well as the limitations of older ~~ones.~~)
2. A strong instinctive feeling for the quality of data, plus experience in judging the data (and analysis) of specific researchers and research groups. (It is important that the evaluator continue to engage in some research, and maintain close contact with other researchers through meetings, seminars, and informal discussions)
3. The application of basic physical laws, nuclear systematics, and the cautious application of nuclear models to the judgement of data and to the analysis and construction of level schemes.
4. The ability to find and use expert evaluations by others whenever they

exist. (Although the mass chain evaluator has the best vantage point from which to view all the data, the time available for his study of a given isotope is extremely limited compared to that of the experimenter who provided the data and (sometimes) a good analysis of them. Furthermore, there are often expert, in-depth evaluations of important quantities, (eg. certain half-lives, very precise radiation energies), or of specialized or highly correlated data (eg. natural abundances, fundamental constants), that are beyond the competence as well as the time available to a mass-chain evaluator. The evaluator has failed in his job whenever he makes a mistake that would have been avoided had he consulted another evaluation.

The principal use of averaging is to combine several comparable measurements that are in agreement. Occasionally, averages of discrepant values (weighted or unweighted, depending on whether the evaluator believes the uncertainties to be meaningful) may be used, simply because no other solution is any better. (See comments on the tritium half-life below.) However, a mass-chain evaluator spends very little of his time on such matters.

APPENDIX: DETAILED COMMENTS ON INDC(CCP)-75/LN

1. Tritium half-life: Inspection of the results in Table I shows that measurements 4 and 6 will completely dominate any statistical analysis of the data which involves the usual weighting with $1/\sigma^2$. The measurements are inconsistent by 14 times the sum of the quoted uncertainties! This is a classic evaluator's dilemma, where one or both of the measurements must be incorrect. A human evaluator would make a detailed study

of these two measurements to find some clue as to which is more reliable. If possible, he would choose one or the other.

If the discrepancy cannot be resolved, but a choice must nonetheless be made, then the choice will always be an arbitrary one. It has been suggested that it would be better to choose one or the other of two discordant values, since there is a probability of ~50% of being correct. If an average value is chosen, it is almost certainly wrong.

A more staisfactory procedure is to choose an intermediate value and assign a much larger uncertainty (perhaps 12.30 ± 0.04). Another acceptable approach is to adopt the "true" weighted average, but to assign an uncertainty which is the larger of "external error" and "internal error," i.e., 12.329 ± 0.033. [Note that the "external error" obtained here from only two measurements is much larger than the value ±0.012 obtained from eight measurements as given in the papers. The less-precise measurements do not affect the weighted average, but they reduce the "external error" by a factor of about $\sqrt{(n-1)}$.]

The computer procedure described in the report will <u>always</u> choose one or the other of the inconsistent values. It will base its choice on the weighted average of the remaining less-precise measurements (12.41 ± 0.04), which also involves inconsistent values. This seems to be extremely tenuous, especially since this number is, itself, inconsistent with both of the precise values. In summary, the computer procedure has arbitrarily resolved the problem of two discrepant measurements, but it has not necessarily provided a <u>good</u> estimate of the true value of the measured quantity.

Note also that a recent evaluation of A=3 [1] might satisfy the evaluator

that the existing discrepancy is not resolvable in the absence of further measurements, thus saving him a lot of time.

2. ^{99}Mo decay γ-ray: The arguments used above apply here, also, except that three precise measurements are involved (1, 3, 5 in Table II). The measurements 3 and 5 are consistent, while measurement 1 is lower by about three times the quoted uncertainty. Unless there is strong evidence to support the lower value, it seems reasonable to ignore it in determining a "best" value. A weighted average of the two consistent values (920.80±0.07) would be acceptable.

Another acceptable solution would be to choose one or the other of the consistent precise values (with its uncertainty). This provides a good estimate of the γ-ray energy, without introducing a new numerical value into the literature.

Note that either procedure gives a result which is larger than that produced by the computer. The computer procedure is still influenced by the low measurement, even though that value has been identified as being inconsistent and perhaps incorrect. If the lower value is as reliable as the higher values, then it should be considered equally with them, and an intermediate value (with expanded uncertainty) should be chosen. The two consistent measurements suggest that the lower value contains an unstated systematic error, however. Strong justification must be presented if the lower value is to be treated equally with the higher values.

A further point: It is important to have a consistent set of measured γ ray energies for an entire decay scheme. Consequently, the set of values from the same measurement may be preferred to a set of averages of several measurements.

3. Speed of light: This is a good example of an important quantity that requires expert evaluation outside the competence of a nuclear mass-chain evaluator. He should instantly recognize this fact and quickly find the relevant, in-depth review [2], which states that "All past determinations of c have been rendered obsolete by Evenson et al.'s recent measurement . . . ." [of the frequency of a certain transition whose wavelength is known to high accuracy].

[1] S. Fiarman and S.S. Hanna, Nucl. Phys. A251, 1 (1975)

[2] E.K. Cohen and B.N. Taylor, J. Phys. Chem. Ref. Data 2, 663 (1973)

Appendix 20

Copy to: S. Pearlstein
WBE/6-25-76

ZENTRALSTELLE FÜR ATOMKERNENERGIE-DOKUMENTATION

Dr. H. Behrens

ZAED · 7501 Leopoldshafen

Dr. W.B. Ewbank
Oak Ridge National Laboratory
Union Carbide Corporation
Nuclear Division
Post Office Box X
OAK RIDGE, TENNESSEE 37830
U.S.A.

KERNFORSCHUNGSZENTRUM
KARLSRUHE

Telefon (07247) 821
Telex 7826755

Postanschrift:
7501 LEOPOLDSHAFEN

Ihr Zeichen	Ihr Schreiben vom	Unser Zeichen	Datum.
		HB/dg/557/76	*25.5.76*

Dear Dr. Ewbank,

Referring to the meeting Nuclear Structure and Decay Data for Applications in Vienna May 3-7, 1976, where we have discussed the "Summary of Basis for Spin and Parity Assignments 1976" (Document AG 59/4), I want to make some comments concerning point 15 to 19 of the document above mentioned.

Point 15: In general A_4 is not zero for allowed as well for forbidden transitions. For allowed transitions $|A_4|$ lies in the range 10^{-6} to 10^{-8}, for first forbidden non/unique transitions in the range 10^{-4} to 10^{-6}. These final values for A_4 are caused by the so-called higher forbidden corrections which you have to take into account for calculating A_4. In some special cases, however, A_4 is zero i.e. if the following relations are not satisfied,

$$|J-J'| \leq L, L' \leq J+J', \quad |L-L| \leq m \leq \min(2J', L+L') \text{ for } m=4$$

see H. Behrens and J. Jänecke
Numerical Tables for beta-decay and electron capture
Landolt Börnstein, Neue Serie Vol. I/4

Point 16 and 17: The same as under point 15 discussed

Point 18: as I believe point 18 should read as follows:

if $J_i = J_f$

β^- $A_1(\beta) < 0$

β^+ $A_1(\beta) > 0$

β^- *if* $J_i = J_f + 1$

$A_1(\beta) \geqq 0$ ✓

if $J_i = J_f - 1$

$A_1(\beta) < 0$ ✓

β^+ *if* $J_i = J_f + 1$

$A_1(\beta) \leqq 0$ ✓

if $J_i = J_f - 1$

$A_1(\beta) > 0$ ✓

Enclosed you will find a copy of the introduction of the Landolt-Börnstein, Neue Serie Vol. I/4 where I have marked the relevant formulae and a copy of a paper, where we have calculated A_4.

Looking forward to hear your comments,

Sincerely yours

(Dr. H. Behrens)

Enclosures

Kopie an: Dr. F. Bertrand
Groningen

Dr. J.J. Schmidt
Vienna

OAK RIDGE NATIONAL LABORATORY
OPERATED BY
UNION CARBIDE CORPORATION
NUCLEAR DIVISION

POST OFFICE BOX X
OAK RIDGE, TENNESSEE 37830

June 22, 1976

Air Mail

Dr. H. Behrens
Zentralstelle für Atomkernenergie - Dokumentation
Kernforschungszentrum Karlsruhe
7501 Leopoldshafen, W. GERMANY

Dear Dr. Behrens:

Thank you for your letter concerning Rules 15-18 of the spin-parity assignments described in the introductory material of the Nuclear Data Sheets. I am in full agreement with the observations you make; however, the following comments should be borne in mind.

Most of the spin-parity rules involving β-decay (log ft, $\beta\gamma(\theta)$, etc.) are based on experimental evidence, not theory; the only exception being Rule 18. Thus, the limits given in these Rules must be revised as new experimental data become available. Rule 15, when written, was based on the 1.47-MeV β^+ in ^{56}Co decay, for which $A_2 = -0.049 \pm 0.010$ had been determined. At that time, this was the largest higher order effect observed for an allowed transition. I believe this is still the case. We picked $|A_2| > 0.1$ as a conservative limit to be used in the statement of this Rule. The further restriction, $A_4 = 0$, was included since, at that time, no allowed β-transitions had been observed to have $A_4(\beta) \neq 0$. The range $|A_4| = 10^{-6}-10^{-8}$, that you mention in your letter, does not invalidate this statement, since A_4 terms of this magnitude have still not been observed experimentally. Again, let me emphasize that the limits on A_2 and A_4 quoted in Rule 15 are empirical values only, and are not meant to imply that A_4 must be zero to infinitely high accuracy. In any event, the restriction, $A_4 = 0$, could be removed from Rule 15 without affecting its usefulness.

Rule 16, as you point out, is no longer correct for first-forbidden β-decays; again keep in mind that the given limit for A_4 is meant to be an empirical limit based on experimental evidence. Are you aware of any experimental evidence for $A_4 \neq 0$ for allowed transitions? Perhaps this rule could be modified on the basis of the data in the reprint article you sent me to read, say, "if $|A_4| > 0.01$, the transition is not first-forbidden"? You would have a better feeling than I for exactly what value for this upper limit would be appropriate.

Dr. H. Behrens June 22, 1976

Is Rule 17 not correct as it stands? Do you know of cases where β-transitions of forbiddenness > 1 are observed to have $A_4 = 0$? In principle, matrix element cancellation could occur, resulting in small A_4-values, so the Rule is questionable on purely theoretical grounds. The use of this Rule is illustrated for the case of ^{124}Sb decay on page 1096 of the book Alpha-, Beta-, and Gamma-Ray Spectroscopy edited by Siegbahn.

Rule 18, as you point out, has some errors in it. Thank you for pointing these out. I don't remember why this rule was expressed as it is, since, after looking back at my notes, it is clear I only considered β^--decay. At the time this rule was introduced, I was not certain that for the case $J_i = J_f$, the term $[J(J+1)]^{-1} - 2y$ would always be positive; hence, I allowed for both positive and negative values for $A_1(\beta)$. This rule should be re-written to include positron decay and to take advantage of the empirical evidence that the matrix element ratio, y, is always small.

Did you have a comment on Rule 19? You make no mention of it except that in your opening statement you mention that you plan to comment on Rules 15-19.

I would be pleased to hear any comments you may have on the above material. Again, let me express my appreciation for your taking the time to study these Rules and to comment on them.

Yours sincerely,

Murray J. Martin

Murray J. Martin
Nuclear Data Project

MJM:sjb

cc: F. E. Bertrand
J. J. Schmidt

cc: S. Pearlstein w/c letter from Behrens

Contributions from East European Countries to Recent References

A. Lorenz

In accordance with the suggestion from the May 1976 NSDD Meeting (Action # 10), IAEA/NDS has asked the German Democratic Republic, Czechoslovakia, Poland, Bulgaria, Hungary and Romania, through the established network of INDC Liaison Officers, to investigate the possibility to organize the preparation of entries to Recent References from nuclear literature published in their countries. Sample letter is attached herewith.

The following replies, expressing readiness to participate in this collaboration and appointing readers to prepare input for Recent References, have been received:

Romania: Mr. Vlad Avrigeanu

Bulgaria: Dr. W. Andrejtscheff
Mrs. Ts. Venkova

17 August 1977

Dear Dr. Rapeanu,

In May 1976, the IAEA convened a meeting of nuclear physicists representing the major centers of evaluation and publication of nuclear structure and decay data (see IAEA report INDC(NDS)-79/LN, December 1976).

In context of the primary objective to establish a common international system for the compilation, evaluation, exchange and dissemination of these data, the meeting suggested

- that an effort be organized in your country to prepare citations of references to nuclear physics articles, particularly those having a bearing on nuclear structure and decay data, published in the open literature of your country, and

- that these citations be prepared in the Recent Reference format and be transmitted on a regular basis so as to be merged with the international Nuclear Structure and Decay Data bibliographic file.

The extended use of the Recent References System, which has been adopted by the participants of the May 1976 meeting as the international system for the compilation and exchange of references to nuclear structure and decay data, would be of great help in the consolidation of an efficient international system for the compilation and exchange of nuclear physics data. Attached for your information is a brief explanation of the Recent Reference System as it appears in the Nuclear Data Sheets journal; a more extensive documentation and input instruction for this system is in preparation and will be sent to you as soon as it is available.

As the next meeting of the international nuclear structure and decay data network is to take place in November 1977, I would appreciate receiving your response to this suggestion before 31 October 1977.

Yours sincerely,

Encl.

Alex Lorens
Nuclear Data Section
Division of Research
and Laboratories

Dr. S.N. Rapeanu
Institut of Nuclear
Power Reactors
P.O. Box 5204
Bucharest, Magurele 7000
Romania

cc/Permanent Mission of Romania

September 1976 1B/76-1

NUCLEAR DATA PROJECT COMPUTER PROGRAMS

INTRODUCTION

At the 1976 meeting of the international network for nuclear structure and decay data (NSDD) in Vienna, the Nuclear Data Project was asked to prepare abstracts of computer programs used by the Project during preparation of Nuclear Data Sheets. The paragraphs that follow present a short statement of the tasks performed by each program, together with a description of input and output quantities and formats. In most cases, a longer writeup is available, and sample runs can be performed to illustrate specific behavior.

The scope of these programs is not exhaustive, but represents a compromise between what must be done and what may be done. Other data evaluation centers will certainly develop other programs for their own use, so the present descriptions may later form part of a longer, continuing report.

All programs run on an IBM/360 computer. Programming languages are: Fortran/4 PL/1, and Assembly language.

I. DATA STORAGE AND RETRIEVAL

A. DBSAVE (PL/1) — This program provides for saving a standard ENSDF data set on a direct access device (disk or data cell) and updates an index to the data. The index entry is generated from the ID-record of the data set by adding a Z-value and deleting blanks. The entry date is added to the ID-record of the saved data set.

Input: Standard ENSDF data sets, beginning with an ID-record and ending with a blank card.

Output: Diagnostic printout and complete updated index to the data file.

Other options: Program is also used to delete superseded data sets from the master file; it may systematically add an additional reference code to all ID-records of the input file; a punch option will prepare a deck including all input ID-records and any control cards.

B. DBFETCH (PL/1) — This program is used to retrieve one or more ENSDF data sets or subsets from the direct access files. Standard ID-records are used as instructions to retrieve single data sets. Multiple data set retrieval is achieved by requesting all data sets for which the ID-records contain certain character strings or do not contain other character strings. A general search may be restricted to a limited range of even and/or odd values of A, Z, and N.

Input: Cards defining the conditions for retrieval from master data file.

Output: Standard ENSDF data sets or subsets retrieved from the master file.

Other options: The program may also be used in edit mode to delete data sets from the data file index. A copy option allows card listing of retrieved data sets.

C. PFT(PL/1) — This program (Pick-from-Tape) will select data for a range of A-values from a tape file of standard ENSDF data sets. The data sets are presumed to be ordered by A and Z, then alphabetically for the rest of the data set ID-label.

Input: Maximum and minimum A-values to be retrieved.

Output: Standard ENSDF data sets copied from the tape file.

II. DATA PRESENTATION AND DISPLAY

A. DBFETCH (PL/1) — Card listing of data sets can be produced as the data sets are retrieved from ENSDF (see I.B, above).

B. MEDLIST (FTN/4) — This program prepares formatted tables of radiations from radioactive atoms. Basic nuclear information is combined with tables of theoretical atomic yields and ratios to produce a complete summary of observed radiations.

Input: Any decay data set in standard ENSDF format. (Conversion coefficients must be included explicitly on continuation cards for the G-record; see ORNL-5054.)

Output:
1. Formatted table of atomic and nuclear radiations, sorted by radiation type and energy.
2. Summary of energy deposited by each radiation type and comparison with Q-value.
3. Decimal file (formatted card-images) of radiations and intensities, in a format adapted from ENDF/B.

Options: An adjustable low-intensity cutoff to limit tables to more intense radiations.

C. NDSLIST (PL/1) — Program prepares tables of data in a format suitable for publication in Nuclear Data Sheets. Any combination of data types can be tabulated for any record type. Any data type may be used to order the table entries.

Input:
1. Table definition instructions.
2. Any data set in standard ENSDF format.

Output: Tables of data for any record type(s) ordered by any data type. Comments and uncertainties are included.

Options:
1. Any selection of data types may be chosen in any order for each record type. The first-mentioned data type is used to order the table.
2. A table can be restricted to only those records which contain a value for a specified data type.
3. Several data sets can be merged to produce a composite table for any data type common to the data sets.

D. NUPLOT (FTN/4) — Program produces a level scheme drawing from any standard data set. Level schemes can be combined to produce complex figures for "Nuclear Data Sheets".

Input:
1. Plot control instructions.
2. Any data set in standard ENSDF format.

Output: Decay scheme drawing, showing some or all levels or radiations appearing in the data set.

Options:
1. Intensity may be normalized or not-normalized, and may include or ignore internal conversion.
2. Drawing size, scale breaks, labeling, and page placement are under complete user control.
3. Drawing may be limited to only a few levels or radiations.

III. DATA ANALYSIS

A. AHINDR (FTN) — Program calculates hindrance factor for each α-transition in a decay data set.

Input: Standard α-decay data set, including parent record and comment giving r_0.

Output: Hindrance factor for each α-branch.

B. ANGCOR (FTN/4) — Program analyzes $\gamma\gamma$-correlation coefficients A_2, A_4 to obtain consistent spins and mixing ratios.

Input: Card containing A_2, A_4 and any available restrictions on J_1, J_2, J_3, δ_{12}, δ_{23}.

Output: Spin sequences and mixing coefficients permitted by $A_2 \pm \Delta A_4$, $A_2 \pm \Delta A_4$.

C. GTOL (FTN/4) — Program uses measured γ-ray energies, uncertainties, and suggested level assignment to deduce a least-squares adjusted set of level energies. The adjusted energies and correlation functions are used to derive a complete set of adjusted γ-ray energies between all pairs of levels. Inconsistencies with input data are flagged. The program also calculates (γ + ce) intensity imbalance at each level for comparison with β- or ϵ-feeding.

Input: Any ENSDF data set containing γ-rays assigned to specific levels.

Output:
1. Heading which gives input and adjusted level energies.
2. Matrix showing calculated γ-ray energy for each pair of levels; input γ-energies are included where available, and discrepancies are flagged.
3. Intensity table showing relative γ- and (γ + ce)-intensity feeding and depopulating each level; absolute intensity imbalance is also calculated and compared with input β-feeding.

D. HSICC (FTN/4) — Program interpolates among tables of Hager–Seltzer (K-, L-, M-shells) and Dragoun–Plajner–Schmutzler (N- + higher shells) to obtain partial and total internal conversion coefficients.

Input: Standard ENSDF data sets.

Output: For each γ-ray (output ordered by γ-energy), partial coefficients are given for eight multipolarities; shell ratios and total ICC are given if available.

E. LOGFT (FTN/4) — Program calculates log ft for each β- or ϵ-branch, average β-energy for each β^+-, β^--branch, and partial capture fractions for each ϵ-branch.

Input: Any decay data set in standard ENSDF format.

Output: For each β- or ϵ-branch, the results are listed together with several intermediate results. A new B- or E-card image is generated for comparison with input.

Options: If desired, the program will produce a new data set, including log ft, β-energy, and capture fractions for each branch.

NS MEMO 1B/76-2
Revised October 1977

PHYSICAL PROPERTIES COMPILED AND EVALUATED BY THE NUCLEAR DATA PROJECT, ORNL

INTRODUCTION

At the 1976 meeting of the International Network for Nuclear Structure and Decay Data (NSDD) in Vienna, the Nuclear Data Project was asked to prepare a list of those physical properties which are included in the *Nuclear Data Sheets* The list presented below is in two parts.

1. quantities that are given for all mass regions;
2. quantities that are relevant to a particular mass region or some other particular circumstance.

If a measurement has been made of any of these quantities, it must be *considered* in preparing the *Nuclear Data Sheets.* It may not be necessary to include the quantity in an ENSDF data set, however, or in *Nuclear Data Sheets* Those quantities which *must* be given are described in "Standards for ENSDF Data Sets" [NS Memo 1B/3 (77); a previous version of this document was distributed at the 1976 Vienna meeting as document AG-59/1]. A complete description of data organization within the ENSDF system is given in ORNL-5054/R1.

I. PROPERTIES COMMON TO ALL MASS REGIONS

A. Adopted Level and γ-Ray Properties

1. Energies (in keV, relative to g.s.).

2. Spin and parity (J^{π}) with indication of reliability of the assignment (and arguments justifying the evaluation in complicated cases).

3. Half-life ($T_{1/2}$) (in time units or total width in keV or eV).

4 Decay branching (%) if the level decays by means other than 100% electromagnetic transition.

5. Static electric and magnetic moments.

6. Q^- (β^--decay energy); S_n, S_p (neutron and proton separation energies); Q_α (α-decay energy).

7. Gamma-ray properties: Placement in level scheme; energy (in keV); intensity branch (normalized to 100 for the strongest photon intensity from each level); multipolarity (including mixing ratio); total conversion coefficient; precise (better than $\approx$5%) experimental conversion coefficients, penetration coefficients; reduced transition probabilities B(Eλ)$\downarrow$ and B(Mλ)$\downarrow$ in single-particle (Weisskopf) units.

B. Radioactivity

1. Energies of α, β, γ radiations (in keV)

2 Intensities of α, β^-, β^+, ϵ, γ, $\gamma^{\pm}$ radiations (conversion to absolute intensities is indicated where possible); quantities related to intensities are calculated (log ft's, α hindrance factors). X-ray intensities are compiled and calculated

3. Other properties of radiations are evaluated or calculated· γ multipolarities (including mixing ratios), K, L, M+ fractions of ϵ decay, average β energies; degrees of forbiddenness of unique β transitions; γ total conversion coefficients, K, L, M+ conversion coefficients, internal-pair formation.

4 Placement of radiations in the decay scheme, coincidence relations.

5. Level properties of daughter nucleus are included if they are derived from the radioactive decay. (However, occasionally the adopted level energies and J^{π} are given.)

C. Nuclear Reactions

1. Level energies observed in nuclear reactions.

2. Angular momentum transfers.

3. Transition strengths: spectroscopic factors (for nucleon transfer reactions); β (for inelastic scattering); B(Eλ)↑ (for Coulomb excitation)

4. J^{π} as determined by the reaction.

5. Gamma-ray properties deduced from the reaction (specify intensity units).

II. PROPERTIES RELATED TO SPECIAL CASES OR SPECIAL MASS REGIONS

A. Adopted Levels and Gammas

1. Configuration assignments (e.g., Nilsson quantum numbers in deformed regions, shell-model assignments in spherical nuclei, isobaric spin in light nuclei).

2 Band properties (e.g., rotational bands in deformed regions, multiplets in lead region).

3. Isomer shifts, isotope shifts (known in a small number of cases).

4. Charge distribution of g.s. (Usually a literature reference is given without further evaluation.)

5. Deformation parameters of g.s. (model dependent).

6. Reduced electric transition probabilities, B(Eλ)↑ [converted to $T_{1/2}$ (level) where possible]

7. Ratio of reduced γ-ray transition probabilities (when level $T_{1/2}$ is not known).

B. Radioactivity

1. Properties of rare forms of radioactivity (proton radioactivity, delayed neutron emission, two-photon emission, internal bremsstrahlung, spontaneous fission, etc.).

2. Conversion-electron intensities are compiled in special cases [for example, in cases of high precision (better than ≈5%) and in cases of penetration effects (including E0 transitions)].

3. β-spectrum shape factors are compiled in cases of special interest.

4. ϵ/β^+ ratios (experimental and theoretical)

5. Angular correlation parameters or polarization results may be compiled for the purpose of documenting J^π and multipolarity assignments, gyromagnetic ratio determinations.

6. Conversion electrons, Auger electrons, and X-rays are calculated in special cases of applied interest.

7. Radiations not observed, but expected to exist on the basis of information from other data sets or from systematics, are occasionally calculated or estimated by evaluators.

C. Nuclear Reactions

1. Cross sections and Q-values are compiled in rare cases.

2. Parameters related to reaction mechanisms are occasionally compiled.

MRS:sjb

October 27, 1977

NS MEMO 1B/3 (77)

STANDARDS FOR ENSDF DATA SETS

I. A-CHAIN COMPLETENESS

For each A-chain, there must be at least one data set for each known isotope. Usually, there will be more. An abstract should be submitted with each A-chain. The literature cutoff date and the compilers/evaluators name(s) are required.

II. ISOTOPE COMPLETENESS

For each nucleus, there must be at least one data set for each distinct type of experiment giving level information about that nucleus.

For each nucleus, there should be one, and only one, "Adopted Levels" or "Adopted Levels, Gammas" data set. By convention, if only one data set exists for a nucleus, that data set will be treated as an "adopted" data set. It must include the Q-record just as for any other "adopted" data set (see IV.A below), and properties of long-lived levels (J, π, $T_{1/2}$, etc.) must be included here even if they were not "properly" deduced from *this* experiment. (If only one data set contains gamma information, that data set will be treated as the "adopted gammas" data set)

III. DATA SET IDENTIFICATION (ID-RECORDS)

No two distinct data sets may have the same ID-record Since we are using the ID-record in a "generic-key" indexing system, all data sets whose names begin with a given sequence of characters can be retrieved as a group, regardless of how the ID-records end. In general, the broadest categories should be mentioned first in the ID-record, with nuances and finer details coming later.

A. Radioactivity

For radioactivity data sets, the data set name (cols. 10-39 of the ID-record) will include the parent isotope and the type of decay (B-, IT, EC, B+, A, SF). Data bank programs will make no distinction between EC and B+ as a decay type.

Isomers should be identified by their half-life (in parentheses) following the decay name.

Some acceptable data set names are

63NI	B-	DECAY	
99NB	B-	DECAY	(2.6 M)
21NA	B+	DECAY	
79SE	IT	DECAY	(3.89 M)
106IN	EC	DECAY	(6.3 M)
106IN	EC	DECAY	(5.32 M).

Note that use of "M" to denote an isomeric state will cause problems for the NDS text editor. It is better to avoid such things as 106MIN (^{106m}In) and 114M2IN (^{114m_2}In).

The half-life of the decaying level should be taken directly from the "Adopted Levels" data set. It is written *without* a hyphen.

B. Nuclear Reactions

Wherever possible, the reaction should be given explicitly, including the target It is not necessary to give the final nucleus, since it is contained in cols 1-5

Some experiments can be grouped efficiently; e.g., COUL. EXCIT could summarize Coulomb excitation by protons, alpha particles, and heavy ions. However, if it is necessary to display them separately in the Nuclear Data Sheets, they must be entered into the data bank as separate data sets.

Some acceptable data set names are

169TM(N,G)
177HG(N,G) PRIMARY GAMMAS
65CU(3HE,A)
90ZR(P,P') IAS (a ^{91}Nb data set)
COUL. EXCIT.
(HI,XNG) REACTIONS
181TA(P,4NG)
181TA(N,G) E = 2 KEV.

C. References

The reference fields (cols 40-64) on the ID-record should be used for no more than three key numbers. If there are more than three principal references for a data set, then the key numbers should be placed on comment cards.

When the data sets are filed into permanent storage, a special identification flag will be added, e.g., 71NDS, 74NDS for published A-chains. This special flag can then be used to help describe a request for information from ENSDF.

D. Date

The date when the data set entered the computer is automatically added by the system Do not write anything in cols. 75-80 of the ID-record, since it will be ignored and lost.

IV. DATA SET CONTENTS

A. All Data Sets

Standard formats should be used unless there are compelling reasons to do otherwise

Uncertainties must be given for all measured values and all adopted values whenever possible! Sometimes a general comment about uncertainties can obviate this requirement. However, no program can yet use an uncertainty which is not given on the same card with the primary quantity. .

Documentation should be included in the ID-record (three key numbers or fewer), or in general comments (for the entire data set), or in specific comments (for individual data items). A copy of every document used in preparing an A-chain must be on file at the Nuclear Data Project in Oak Ridge. Each compiler is responsible for sending in copies of private communications and special reports. which may have been received directly by him. Since the reference list is generated automatically, *every relevant key number* for an A-chain must appear in some data set If many references are used in a data set, you should be more specific as to

IV.A. Continued

which data items come from each reference. In general, all experimental numeric information is obtained *only* from experiments "belonging" to the data set as identified by its ID-record. Numbers which are "borrowed" from the "Adopted Levels, Gammas" data sets should be flagged by including the letter "A" *before* the "borrowed" number, for example,

	Col ⑧ ⑩		⑧ ⑩
for γ energy:	G A371.5,	for level half-life	L A4 25 H

Comment Records (C in col. 7)

Comment records may contain any number of cards. The first card must contain a "blank" or "1" in col. 6. The first card contains all information needed to determine what the comment is talking about and how it is to be processed. Continuation cards must have a character different from blank or one in col. 6. The comment text on continuation cards may begin in any column, 10–80. You should start new paragraphs on a new card. Avoid hyphenating words at the ends of cards.

1. General comments (blank in col. 8) must be placed at the beginning of a data set. The comment text may begin in any column, 10–80. The NDSLIST program will preserve the spacing.

2. Data comments (record type in col. 8 and data type in cols. 10–19 of the first card) are of two types. For both types, the comment text may begin in any column, 20–80, of the first card, but NDSLIST may not preserve leading or trailing blanks.

   a) Single-item data comments contain information about a single data item on a single record in a data set This comment record *must follow* the record containing the data item being explained.

   b) Footnote comments contain information about several items of the same data type in the same data set. These comments must be placed at the beginning of a data set.

      If a footnote applies to all entries of the given data type, only the data type is placed in cols. 10–19 of the first card of the comment record These comments appear as footnotes to a column heading in a table.

      If a footnote applies to only a few records, those records may be "tagged" in col. 77 (C-field) with any single character. The character must then be placed in parentheses following the data type in cols. 10–19; e.g., RI(A), E(*). These comments appear as footnotes to the several tagged data items in a table.

B. "Adopted Levels, Gammas" or "Adopted Levels" Data Sets

1. Q-Record

The *adopted* data set for a nucleus must contain the Q-record for that nucleus. The Q-record must contain $Q(\beta^-)$, S_n, S_p, and Q_α. A reference for the Q-values should be included in cols. 56–80 This may be a standard adjustment (71WaGo, 77Wa08) or a new key number, or both. Whenever more than one reference is used, an explanation must be given on an accompanying comment record.

IV.B. Continued

2. Level Records

a) A first card is required for each level.

Energy field may contain the letter X or Y if the energy of the level relative to the g.s is not established.

Spin-parity assignments are based on arguments enumerated in "Rules for Spin-Parity Assignments", published in each issue of *Nuclear Data Sheets*

Half-life must be given if known A total level width may be placed in the T-field (The units, eV and keV, are used to distinguish $T_{1/2}$ from Γ.) If only B(Eλ)↑ has been determined for the level, it should go on a continuation card. If no decay has been observed, the half-life of the level should be given as "STABLE".

Rotational bands *must* be connected by a comment record with "BAND(X)" in cols. 10-19, where X is a footnote letter in col. 77 of the first card of each level belonging to the band. You should do this even if only one level of the band has been identified.

Rotational bands in deformed nuclei should be identified by Nilsson numbers if available.

```
Col  (7) (10)        (20)
     CL  BAND(A)     9/2(514)
     CL  BAND(B)     P,1/2(620)+N,5/2(633)
     CL  BAND(5)     K=0⁻ OCTUPOLE VIBRATION
```

In spherical nuclei, levels belonging to a similar configuration may be connected by a comment record with CONF(X) in cols. 10-19

```
Col  (7) (10)        (20)
     CL  CONF(A)     (206PB 2+)(N,F5/2,-1)
```

b) Continuation cards (sequence number in col. 6) *must* be used in the following cases.

If a level decays by means other than 100% electromagnetic transition, the percent branching *must* be given. If the branching is not known precisely, an entry is still required; e.g., %IT AP 100, %A <= 5E-6 If only one decay branch has been observed, use, for example, %A > 0

If a half-life is not shown on the first card, but a B(Eλ)↑ is known (from, for example, Coulomb excitation), the B(Eλ) should be placed on a continuation card. By convention, the data types BE1, BE2, . for a *level* refer to direct excitation of the level from the ground state (upward transition, i.e., B(E1)↑, B(E2)↑,)

Static electromagnetic moments for a level must be given if they have been determined.

3. Adopted Gamma Records

The adopted gamma-ray properties will be part of the "Adopted Levels, Gammas" data set The adopted RI are the photon intensities normalized to 100 for the strongest γ transition from each level When possible, reduced γ-ray transition probabilities will be given in single-particle (Weisskopf) units. Internal conversion data will be given as in IV.C.3.

C. "Decay" Data Sets

1. Normalization record must be given if an absolute normalization is possible.

   NR × RI gives photons per 100 decays *of this type.*
   NT × TI gives total (γ + ce) transitions per 100 decays *of this type*
   BR × NR × RI gives photons per 100 decays *of the parent level.*
   NB × IB gives β intensity per 100 decays *of this type.*

   If the NR-field is blank, it is presumed to be *unknown.* If the BR-field is blank, it is presumed to be exactly 1 0

   Methods used to obtain the normalization factors must be explained on accompanying comment cards.

2. Parent records are required for A, B-, B+, EC decay data sets, but not for IT or SF.

   Comments on properties of the parent level belong with the "Adopted Levels" data set for the parent nucleus and should be shown there.

3. Gamma records always include energy. (The energy may be only approximate or it may be derived in a manner described on comment cards.)

   Records for unplaced γ rays must also be included. They are placed *before* the first *level* record in the data set.

   Gamma-ray multipolarities and mixing ratios must be included if they are known. An assumed multipolarity is written with the word "IF", for example. "IF E1", "IF M1 + E2".

   Whenever internal conversion is important, the theoretical value will normally be given for α_T (the CC-field). Any other value must be explained in a comment. If a precision measurement is available, it should be included α_K, α_L, α_M+ conversion coefficients (as produced by the HSICC program) should be included (on second cards).

   Conversion-electron (ce) data (I_{ce}, ce-ratios, measured α_1) should be given (on continuation cards) if they are very precise Each measurement given here must have a reference.

4. An alpha, beta, or EC-record must be included for every established branch.

   The energy field is to be filled in only if there has been a precise direct measurement. Analysis programs and NDSLIST use the parent record and level record to derive a decay-branch energy

   If the IB-field on an E-record is blank, then the IE-field is presumed to contain total intensity, $I_\epsilon + I_{\beta+}$. Alternatively, the total feeding to a level can be given in the TI-field. The plot program ignores the TI-field NB × BR × TI is the $I_\epsilon + I_{\beta+}$ intensity in % of parent decay.

   Don't forget "1U" or "2U" in cols 78-79 for unique transitions.

   CK, CL, CM+ fractions of ε decay and average β energies (as calculated by the log ft program) should be included (in continuation cards)

IV Continued

D. Reaction Data Sets

1. Level Records

Give J^{π} or L-value if it is established or suggested by this particular reaction.

Give transition strength (C^2S or C^2S' or β) as determined from this reaction Explain which quantity is given in a comment

2 Gamma Records

See notes above for "decay" data sets.

Relative photon intensity should be given if it is available.

WBE:MRS sjb

October 25, 1977

DRAFT 11/4/77

NORMAL PROCEDURE FOR MASS-CHAIN EVALUATION

1. Author notifies ORNL that evaluation is beginning for A = **

2. NDP sends to Author:
   a) Complete indexed reference list for nuclei with A = **,
   b) Complete listing of ENSDF card-images for A = **,
   c) NDSLIST listing of all ENSDF data for A = **.

3. NDP begins regular monthly distribution of new references on A = **

4. As evaluation proceeds:
   a) Unusual documents are obtained by Author from NDP,
   b) Copies of private communications and other unusual sources are sent by the Author to NDP for keynumber assignment and for inclusion in the NDP library,
   c) Parts of an A-chain may be sent to NDP (cards or tape) for processing with NDP programs which are not available locally.

5. When the evaluation is complete, the Author will send all data sets for A = ** to ORNL/NDP, together with a complete card listing.

6. NDP will merge the data sets onto a temporary file, after correcting any serious format errors. (All changes will be marked on the Author's original card listing.)

7. NDP will prepare from the submitted data sets:
   a) Preliminary NDSLIST, including tables of all data types from all data sets, in ENSDF-index order,
   b) Preliminary drawings, including a drawing for each data set and a summary drawing for the entire mass chain,
   c) Preliminary reference list.

NDP will also perform certain standard calculations and consistency checks on the submitted data sets. The preliminary manuscript and all relevant printouts will be sent to the Author, together with the Author's original card listing (marked as necessary) and two copies of the current card listing.

If these preliminaries suggest that major revisions of the data sets may be required, NDP will also return a tape copy of the current data sets, together with some general comments about how the data sets must be improved. After the data sets have been expanded or corrected, the mass chain should be resubmitted to NDP as in item 5, above.

8. The Author will inform the Editor of Nuclear Data Sheets when the data sets for A = ** are complete. An abstract for the data evaluation and a copyright-release letter must also be sent to the Editor.

9. NDP will prepare 2 copies each of:
   a) Semifinal NDSLIST, including tables of data prepared in the standard order for Nuclear Data Sheets,
   b) Semifinal drawings organized into page layout,
   c) Semifinal reference list with all keynumbers identified,
   d) Preliminary abstract page.

   One copy will be sent to the Author; the other copy will be assigned to a Referee for review. (See Section G.2.C in main body of report)

10. The Referee will send to the Editor a report on the review of the submitted manuscript for "Nuclear Data Sheets for A = **".
    a) If the manuscript is acceptable for publication in Nuclear Data Sheets, as regards completeness and correctness, the Referee's report will recommend prompt publication.
    b) If the manuscript is generally satisfactory, but contains certain errors or omissions, the Referee's report should document the problems in sufficient detail that the Author can take remedial steps.

c) If the first few pages of a manuscript contain substantive or systematic errors, the Referee may reject it without further examination. Clear justification must be presented in the written Referee's report.

11. If a manuscript has been recommended by the Referee as acceptable for publication in Nuclear Data Sheets (10a, above):
    a) The Editor will promptly notify the Author and assign a tentative publication date,
    b) Last-minute corrections of typographical or other minor errors should be sent *immediately* to NDP,
    c) The Editor may also authorize changes in grammar, spelling, punctuation, and layout as may be required to ensure a uniform high quality for Nuclear Data Sheets (any such changes will be reported to the Author),
    d) The manuscript is now *accepted for publication* in Nuclear Data Sheets, and the Author's commitment to revise "Nuclear Data Sheets for A = **" has been completed,
    e) NDP will prepare final manuscript for publication. Five preprint copies will be sent to the Author at the same time photoready copy is sent to the publisher.

12. If the Referee has suggested minor changes (10b, above):
    a) The Editor will consider the referee's comments, and send a copy of the Referee's report to each Author,
    b) The Author should mark data set revisions on one copy of the ENSDF card listing and return it to NDP,
    c) NDP will make the changes and prepare a revised semi-final manuscript (item 9, above), a copy of which will be sent to the Author,
    d) The Editor may accept these changes as complying with the Referee's recommendation, or the Editor may make further consultation with the Author and the Referee until an acceptable manuscript is prepared. The manuscript is then processed as in item 11, above.

13. If the manuscript requires major revisions (10c, above):
    a) The Editor will consider the referee's comments, and send a copy of the Referee's report to each Author,

b) The Author will make modifications at his own institution, and the manuscript should be resubmitted as in item 5, above,

c) The Editor may ask for a second Referee's opinion and proceed as in item 10, above.

14. After a manuscript has been accepted for publication in Nuclear Data Sheets, the Author is required to:

a) Inform NDP about disposition of older information contained in ENSDF (in principle, all older data sets have been superseded and may be deleted),

b) Provide NDP with data sets (if any) to be preserved in the "working file" of (unevaluated) experimental data,

c) Inform NDP about changes in status for reference-file entries. (This will provide the most reliable means of flagging unimportant, incorrect, or superseded references.)

15. If the Author believes that changes suggested by the Referee are not justified or are incorrect, an appeal may be made through the Editor using the established arbitration procedure. (See Section G.2.C in main body of report)

ORNL/NDP SUPPORT SERVICES TO OTHER EVALUATION GROUPS

I REFERENCE SERVICES

A. Regular Schedule

1 Monthly list of new references for A-chains in progress (ordered by nucleus)

2. Four-month cumulation of new references (matching "Recent References" schedule) for the group's entire A-region: one list ordered by NDP key number, the other ordered by nucleus

B. Services Provided on Request Only

1. Complete indexed reference list for one or more A-chains, ordered by nucleus or by key number

2. Selected bibliographies on special topics

3 Magnetic tape copy of the complete NSR file

4. Magnetic tape copy of a part of the NSR file, selected by A-value or by publication date

5. Preprints of "Recent References"

6. Copies of private communications and other information sources that are not available elsewhere

II. DATA SERVICES

(On Request Only)

A. Complete copy of ENSDF on magnetic tape (distributed through BNL twice each year)

B. Magnetic tape files of specified parts of ENSDF

C. Lists or drawings from NDP programs operating on data from selected parts of ENSDF

D. Lists or drawings from NDP programs operating on new data sets

E. File and retrieve unevaluated data sets which an evaluator wishes to preserve for later use

WBE:sjb
November 4, 1977

Transcript of the Report of the ad hoc Subcommittee on

J^{π}-ASSIGNMENTS, ERRORS, AND RELATED MATTERS

C. van der Leun

As instructed by our chairman, the Subcommittee convened yesterday in the back of the bus during the excursion to the Smokey Mountains. From the fact that we did not wake you up, gentlemen in the front-seats, you may conclude that it was a quiet meeting. Indeed, the conclusions were reached without any fighting or shouting. I must confess, however, that the Committee had to cope with a few other difficulties.

In the first place our chairman asked for a majority and a minority report. The Committee, however, turned out to consist of two parties of equal size. Since our modesty is well known to you all, you will understand that it was not easy to decide which party had the right to claim the minority position. After a thorough discussion the two of us decided that we would take all our decisions unanimously. That's what we did.

The second problem was -you will have noticed this yourself- that the bus was of a rather primitive type. There was no blackboard. There was not even a slide-projector. Physicists talking without blackboard and without slide-projector have correctly been compared to blind-folded people taking part in a sack-race. Notwithstanding these difficulties we managed to concentrate mainly on the assignment of J^{π}'s, although we also considered some apple-pies.

The strong arguments for J^{π}-assignments are in good shape. Our first and only recommendation is that one item be added to the NDS list. The natural or unnatural parity-assignments based on recent (d, α) work with polarized deuterons really seem highly reliable. This fantastically nice work has provided a lot of valuable information. The Committee reached this conclusion virtually without discussion.

The weaker arguments -just as the sexes- are considerably more interesting and their shape obviously attracts more attention. The Subcommit-

tee recommends inclusion of the following items in the NDS list of weak arguments for J^{π}-assignments:

- "as reported in earlier Nuclear Data Sheets",
- "it is well known that ...",
- "I believe", and
- growing spin-assignments. This does not refer to spins starting as J=1, which as they come of age grow to J=5 or 6, but to the following phenomenon, generally known to reviewers. A paper starts by saying that the experiment excludes $J^{\pi} = 1^{-}$, but is not inconsistent with $J^{\pi} = 4^{+}$. The next page states that the level "possibly has 4^{+}", and one page furtheron, it "probably has 4^{+}". The figure gives (4^{+}), quasi-decently bracketed, but in the conclusion and in the title and abstract -the sections most frequently read- the authors are discussing *the* 4^{+} level. Of course this is only an example. Our recommendation would be to accept -and then at best as a weak argument- the statement that is closest to the experimental part of the paper.

In setting up our Subcommittee the network also invited us to think a little bit about error-assignments. Owing to shortage of time we were unable to come to more than one conclusion in the field of errors. We recommend that errors be assigned to the J-assignments, with the imperative restriction that $\Delta J < 1/2$.

Finally the Subcommittee devoted some time to discussing the venue of our next meeting. Although this topic comes up under item 4 of this morning's agenda, I would like to mention a few points here. In view of yesterday's inclement weather (I hope our interpreters have an adequate Russian equivalent for "inclement"; I did not know it was an English word, but our gentleman from Liverpool has no doubts in this respect) the Subcommittee feels that our hosts should have another chance to show us the Smokey Mountains on a sunny day, preferably in all their autumnal splendour. Therefore our suggestion would be to discuss the J^{π}-assignments, the errors and the T-assignments in detail during another meeting in Oak Ridge one or two years from now. We have noticed a few very nice places on our way to the Smokey Mountains. For instance there is the Mu-

seum of the World of the Unexplained. Wouldn't this be an excellent place to discuss all the discrepancies which have popped up so frequently this week? Very close to the museum we noticed another sign: "Believe It or Not"; this of course refers to the strong arguments and the weak arguments, respectively.

As I said, we'll come back with a few additional suggestions under item 4. Therefore I would like now to summarize this report by saying that it is the Subcommittee's way of saying "thank you" to Bruce Ewbank and Fred Bertrand and all the other people from the Oak Ridge NDG for the great hospitality extended to us during last week, when so many of us were here to discuss the physics of our reviewing job, and especially the problems of J^{π}-, T-, and error-assignments. Naturally I am not talking about this week - I would not dare interfere with our chairman's duties.

Addresses of Active and Potential Members of the NSDD Network

(Active evaluation and distribution centers are indicated by an asterisk)

Code	Centre/Group		Address	Head of Project or Centre
1A	US/NNDC	*	National Nuclear Data Center Brookhaven National Laboratory Upton, New York 11973, USA	S. Pearlstein
1B	US/NDP	*	Nuclear Data Project Oak Ridge National Laboratory Oak Ridge, Tennessee 37830, USA	W.B. Ewbank
1C	US/LBL	*	Lawrence Berkeley Laboratory University of California Berkeley, Calif. 94720, USA	C.M. Lederer
1D	US/INEL	*	EG and G Idaho, Inc. P.O. Box 1625 Idaho Falls, Idaho 83401, USA	R.L. Heath
1E	US/UP	*	University of Pennsylvania Philadelphia, Penns. 19174, USA	F. Ajzenberg-Selove
2A	USSR/CAJAD	*	Institut Atomnoi Energii I.V. Kurchatova 46 Ulitsa Kurchatova Moscow, D-182, USSR	F.E. Chukreev
2B	USSR/LIYAF	*	Data Centre Leningrad Nuclear Physics Inst. Gatchina, Leningrad Region 188350, USSR	I.A. Kondurov
3A	NED/UTRECHT	*	Fysisch Laboratorium Sorbonnelaan 4 Utrecht, The Netherlands	C. Van der Leun
3B	NED/IKO		IKO Inst. for Nuclear Research 18 Oosterringdijk P.O. Box 4395 Amsterdam-1006, The Netherlands	A.H. Wapstra
4A	UK/Daresbury	*	Oliver Lodge Laboratory University of Liverpool Liverpool L69 3BX, UK	P. Twin
4B	UK/BNL		Berkeley Nuclear Laboratories Research Department Berkeley Gloucestershire GL13 9PB United Kingdom	B.S.J. Davies

Code	Centre/Group		Address	Head of Project or Centre
5A	FRG/ZAED	*	Fachinformationszentrum Energie, Physik, Mathematik G.m.b.H. Karlsruhe Kernforschungszentrum D-7514 Eggenstein-Leopoldshafen 2	H. Behrens
5B	FRG/Juelich		Kernforschungsanlage Juelich Ges.m.b.H. Postfach 1913 D-5170 Juelich	G. Erdtmann
6A	FR/LMRI		Centre d'Etudes Nucleaires de Saclay B.P. No. 2 F-91190 Gif sur Yvette, France	J. Legrand
6B	FR/CEA-Grenoble		Centre d'Etudes Nucleaires de Grenoble Cedex No. 85 F-38041 Grenoble Gare	J. Blachot
7A	IAEA/NDS	*	Nuclear Data Section International Atomic Energy Agency P.O. Box 590 A-1011 Vienna, Austria	A. Lorenz
8A	NEA/CCDN		NEA Neutron Data Compilation Centre B.P. No. 9 F-91190 Gif sur Yvette, France	H. Derrien
9A	CBNM/Geel		Bureau Central de Mesures Nucleaires C.E.C. Steenweg naar Retie B-2440 Geel, Belgium	W. Bambynek
10A	JAP/JAERI	*	Japan Atomic Energy Research Inst. Division of Physics Tokai-Mura, Naka-Gun Ibaraki-Ken 319-11, Japan	T. Tamura
10B	JAP/Hokkaido		Department of Physics Hokkaido Univ. Sapporo, Hokkaido, Japan	H. Tanaka
11A	SWD/Lund	*	University of Lund Institute of Physics Solvegatan 14 S-223 62 Lund, Sweden	B. Erlandsson
12A	KUW/ISR	*	Kuwait Institute for Scientific Research Shuwaik, Kuwait	A. Shihab-Eldin
13A	ITY/CNEN-Bologna		Centro di Calcolo del C.N.E.N. Via Mazzini 2 I-40138 Bologna, Italy	G. Reffo

Code	Centre/Group	Address	Head of Project or Centre
14A	ROM/IPA	Institut de Physique Atomique de Bucarest B.P. No. 35 Bucarest, Roumanie	M. Ivascu
15A	HUN/INR-Debrecen	Institute of Nuclear Research P.O. Box 51 H-4001 Debrecen, Hungary	D. Berenyi
16A	POL/IBJ-Warsaw	Institut Badan Jadrowych Hoza 69 PL-00-681 Warsaw, Poland	A. Marcinkowski
17A	INDC/BARC	Bhabha Atomic Research Centre Trombay, Bombay 400 085, India	M.K. Mehta
18A	GDR/TU-Dresden	Sektion Physik Technische Universitaet Dresden Mommsenstr. 13 DDR-8027 Dresden, German Dem. Republic	D. Seeliger