



International Atomic Energy Agency

INDC(SEC)-77/GA

INDC

INTERNATIONAL NUCLEAR DATA COMMITTEE

First Meeting of the IFRC Subcommittee
on Atomic and Molecular (A+M) Data for Fusion

IAEA, Vienna, 19-20 January 1981

SUMMARY REPORT

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

February 1981

IAEA NUCLEAR DATA SECTION, WAGRAMERSTRASSE 5, A-1400 VIENNA

Reproduced by the IAEA in Austria

81-1506

First Meeting of the IFRC Subcommittee
on Atomic and Molecular (A+M) Data for Fusion

IAEA, Vienna, 19-20 January 1981

SUMMARY REPORT

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

February 1981

Abstract

The IAEA Nuclear Data Section convened the first meeting of the Subcommittee on Atomic and Molecular Data of the International Fusion Research Council (IFRC) in Vienna, Austria from 19-20 January 1981. Members of this IFRC Subcommittee met to review the IAEA programme on Atomic and Molecular (A+M) Data for Fusion, and made specific recommendations regarding the bibliographic and numerical data centre services to the fusion community.

Table of Contents

	<u>Page</u>
I. <u>Summary of the Meeting</u>	1
A. Introduction	1
B. Conclusions and Recommendations	1
C. Next Meeting	1
II. <u>Meeting Proceedings</u>	2
A. Subcommittee Composition and Organization	2
B. IAEA A+M Data Unit	2
C. Terminology	2
D. Bibliographic A+M Data	2
E. Numerical A+M Data	6
F. IAEA Coordinated Research Programmes	9
G. International A+M Data Centre Network	9
H. IAEA A+M Data Meetings	10

List of Appendices

Appendix 1	List of Participants	11
Appendix 2	Adopted Agenda	12
Appendix 3	Terms of Reference	13
Appendix 4	Methods of Work	14
Appendix 5	Membership List as of January 1981	16
Appendix 6	Current Status and Plans of IAEA A+M Data Programme, by R.A. Langley	17
Appendix 7	Definition of Terms	19
Appendix 8	Fusion Relevance Criteria for the IAEA Bulletin Input	20
Appendix 9	Indexation Guideline for Surface Effects Data	23
Appendix 10	Organization of the Non-indexed Part of Bulletin	24
Appendix 11	List of Suggested Experts for A+M Data Evaluation	25

I. Summary of the Meeting

A. Introduction

The first meeting of the IFRC Subcommittee on A+M Data for Fusion was convened at IAEA Headquarters in Vienna, Austria, 19-20 January 1981. The meeting was attended by seven of the eight members of the Subcommittee, and staff of the IAEA Nuclear Data Section. The list of participants is given in Appendix 1. The Adopted Agenda is given in Appendix 2.

B. Conclusions and Recommendations

While a more detailed account of the meeting proceedings is given in Part II of this report, the main conclusions and recommendations made by the Subcommittee are summarized as follows:

The Subcommittee

- reviewed the status of the IAEA A+M Data for Fusion programme, and gave general guidelines regarding its future role and activities,
- emphasized the provision of recommended A+M data to the fusion research community as an important objective and task of the IAEA A+M data programme,
- recommended to this effect, that the IAEA A+M Data Unit maintain an international co-operative effort with the participation of national and regional A+M data centres, and act as a coordinating centre for this effort,
- made specific recommendations regarding the information scope, literature coverage and presentation in the International Bulletin, on A+M Data for Fusion,
- encouraged the promotion of sales of the CIAMDA index to A+M collision data and made recommendations regarding its future publication,
- suggested the publication of a similar bibliographic index on surface effect data,
- strongly recommended that IAEA stimulate and support the evaluation of needed A+M collision data, and identified specific priority topics and reviewers for these evaluations,
- endorsed the two coordinated research programmes on atomic collision and surface interaction data initiated by the IAEA A+M Data Unit, and
- made specific recommendations on the frequency of future IAEA meetings on A+M Data for Fusion.

C. Next Meeting

The Subcommittee agreed that it should meet not later than two years after this meeting.

II. Meeting Proceedings *

A. Subcommittee Composition and Organization

The Subcommittee reviewed the Terms of Reference of the Subcommittee as drafted by the IAEA (given in Appendix 3), and formulated its Methods of Work. The Methods of Work, as approved by the members of the Subcommittee, are given in Appendix 4.

Members of the Subcommittee endorsed the proposal to have P.M. Stone serve as first chairman of the Subcommittee, and to include A. Lorenz, the Subcommittee's Scientific Secretary, in the membership of the Subcommittee.

The current composition of the Subcommittee is listed in Appendix 5.

B. IAEA A+M Data Unit: Programme and Function

- B.1. Progress report: the progress report of the IAEA A+M Data Unit was presented by R.A. Langley (Appendix 6).
- B.2. Function of the A+M Data Unit: in reviewing the A+M data programme and its relationship with other A+M data centres, the Subcommittee made the following recommendation.

Recommendation on the function of the IAEA A+M Data Unit

The over-all objective of the IAEA A+M Data Programme is the establishment of an international data centre service to provide the fusion research community with bibliographic data, as embodied in the International Bulletin on Atomic and Molecular Data for Fusion and the CIAMDA index of atomic collision data, and with recommended numerical A+M data of adequate and uniform quality and acceptable accuracy.

In order to achieve these objectives the Subcommittee recommends to maintain an international co-operative effort with the participation of national and regional A+M data centres for which the IAEA A+M Data Unit acts as a co-ordinating centre.

* All statements formulated by the Subcommittee are framed.

B.3. Recommendations from the May 1980 Technical Committee Meeting on A+M Data for Fusion: the Subcommittee endorsed the Report of the Working Group on International Cooperation (IAEA report INDC(NDS)-120/W, October 1980) which outlined the basic features of the IAEA A+M data programme.

B.4. Current Awareness: the Subcommittee expressed its concern that the staff of the IAEA A+M Data Unit maintain a closer contact with the technological developments in fusion. In this context it recommended that:

- the A+M Data Unit be put on the distribution of fusion technology and plasma physics reports originating at the major fusion laboratories, and
- that the staff of the IAEA A+M Data Unit be given ample opportunity and support to visit fusion and plasma physics laboratories.

C. Terminology

With the aim of establishing a common usage of terminology in the A+M data field which would correspond to the accepted usage in the nuclear data field, the IAEA submitted a list of definitions for consideration by the Subcommittee. The list of "Definition of Terms" (given in Appendix 7) was approved and endorsed by the Subcommittee.

D. Bibliographic A+M Data

D.1. International Bulletin on A+M Data for Fusion

Discussions on the IAEA Bulletin concentrated on three points:

- the fusion relevance criteria,
- literature coverage, and
- presentation of the information in the Bulletin.

Throughout the discussions, the effect of an eventual termination of the U.S. Bulletin on Atomic Data for Fusion (presently issued jointly by the Oak Ridge National Laboratory and the National Bureau of Standards), was taken into consideration.

a) Fusion relevance criteria

With regard to the fusion relevance criteria which have been used in determining the physics scope of the input to the IAEA Bulletin for atomic collision and structure data, the Subcommittee endorsed a proposed revision of the original criteria (see Nagoya University report IPPJ-AM-15, p. 11, September 1979) which have been used until

now in the preparation of the IAEA Bulletin. The revised set of criteria are given in Appendix 8. With regard to surface effects data, the Subcommittee instructed the A+M Data Unit to develop a similar set of fusion relevance criteria based on the new indexation guideline for surface effects data (see Appendix 9). In order to maintain a uniform and consistent content of the future IAEA Bulletin, the Subcommittee acknowledged the fact that all contributions to the IAEA Bulletin from external sources will have to be submitted to the same fusion relevance criteria as the input generated by the A+M Data Unit.

b) Literature Coverage

The Subcommittee expressed general concern that the coverage of the refereed journals in the IAEA Bulletin be as complete as possible, and that it be expanded to cover laboratory reports as well; in this context, it endorsed the proposal to put the IAEA A+M Data Unit on the distribution of fusion and plasma physics reports originating in the major fusion laboratories. The Subcommittee also felt that the agreements reached between the IAEA and the two laboratories responsible in the U.S.A. to produce the US Bulletin, namely to send the input of the US Bulletin to the IAEA, would significantly improve the literature coverage of the IAEA Bulletin. It was furthermore encouraged that IAEA obtain similar information from the surface effects reference compilation work performed at the IPP Garching in Germany.

c) Presentation of information

To improve the Index to Recently Available Data, Section (II) of the IAEA Bulletin, the Subcommittee suggested the addition of a sub-section which would consist of references to articles, reports, etc... which cannot be indexed according to the input criteria given in Appendix 8, but which contain general information on numerical data pertinent to fusion. The classification of the information in this section of the Bulletin should be based primarily on the physical process described (e.g. ionization). The Subcommittee also endorsed a proposed indexation guideline for surface effects data (Appendix 9) in Section II of the IAEA Bulletin, and the organization and scope of the content of the non-indexed section (IV) of the IAEA Bulletin, given in Appendix 10. Information in Section IV of the Bulletin should consist only of fusion and A+M data relevant references which contain no indexable data.

In summarizing the discussion on the IAEA Bulletin, the Subcommittee made the following concluding recommendations:

Recommendation on the Bibliographic Atomic Data Input

The Subcommittee agrees to the list of reactions, the modified classification for species, and the range of interaction energies as described in Appendix 8 to be the basis for selection of input to the Bulletin. It recommends that this selection procedure be published annually in the Bulletin.

Section II of the Bulletin (Index to Recently Available Data) should include reference to articles that include general expressions formulae, scaling laws and tables (theoretical or experimental) that have previously been listed only in Section III. This change will ensure indexing of these articles for future reference in CIAMDA. This should be done retroactively.

References in Section III of the Bulletin (other literature), should have a short description of their relevance to fusion, as it is presently done in the US Bulletin.

The list of reviewed periodicals has to be enlarged to cover all fusion related journals. The list of these journals should be published annually in the Bulletin. The Subcommittee also encourages the IAEA A+M Data Unit to increase its effort to collect laboratory reports from throughout the world.

Recommendation on the Bibliographic Surface Effects Data Input

The Subcommittee recommends that surface effects processes be indexed according to the classification outlined in Appendix 9.

The set of "fusion relevance" criteria for surface effects processes to be used for input selection are to be based on the following:

- (i) incident particles: limited to classes 1-7 of particles and elements (including their ionized states) listed in Table 2 of Appendix 8.
- (ii) surface materials: limited to classes 6, 7 and 8 of elements listed in Table 2 of Appendix 8, including compounds and alloys composed of these elements, and
- (iii) energy range: guidelines given in the Working Group Report on Plasma-Surface Interaction for Fusion Needs, Submitted at the Second Technical Committee Meeting on A+M Data for Fusion, in May 1980, at Fontenay-aux-Roses (INDC(NDS)-120/W, pp. 26-29).

The description of the criteria used for the selection of input for the Bulletin shall be published annually in the Bulletin.

D.2. CIAMDA

The first edition of CIAMDA, the index to the literature on atomic and molecular collision data relevant to fusion research, was published by the IAEA in May 1980. Since the date of publication approximately 125 copies (of the 1000 printed) have been sold.

Statement on the Promotion of CIAMDA Sales

As the possibility to publish further editions of CIAMDA by the IAEA depends critically on the sales of the first edition, the Subcommittee made a strong recommendation to promote the sales of CIAMDA using all possible means of advertisement.

Regarding the publication of updated versions of CIAMDA, the Subcommittee felt that supplements to CIAMDA, or updated editions of CIAMDA, should not be produced more frequently than every two years.

Information in the CIAMDA publication is sorted by reactants (i.e. incident particle and target) which precludes the inclusion of references which are not indexable by reactants in the CIAMDA data base. As it would be desirable to include in CIAMDA references containing information on numerical data procedures, etc..., even if they are not indexable in CIAMDA, the Subcommittee felt that it would be desirable to alter the CIAMDA input procedure in order to allow the inclusion of such references.

D.3. Other bibliographic data indexes

The Subcommittee endorsed the recommendation on "Other Data Indexes", made by the Working Group on International Cooperation at the May 1980 Technical Committee Meeting on A+M Data for Fusion (INDC(NDS)-120/W, para. 13.3), and requested that the IAEA formulate a proposal for a bibliographic index on surface effects data.

E. Numerical A+M Data

E.1. After extensive discussions on the nature of evaluated data, the need of users, the availability of the required data, and on the basic charter given the IAEA, namely to supply users with recommended numerical A+M data, the Subcommittee made the following recommendations.

Statement Regarding Numerical A+M Data

An important objective and task of the IAEA A+M Data Unit is to provide recommended data to the fusion community.

To achieve this aim, the Subcommittee recommends that the A+M Data Unit use the mechanisms at its disposal, namely the convening of experts meetings and the establishment of coordinated research programmes.

In the area of atomic physics data, the Agency should convene meetings of expert atomic and fusion scientists, nominated by the IFRC Subcommittee on A+M Data, whose task it would be to evaluate all existing information (i.e. data, theoretical considerations, etc...) on specific priority processes, and to arrive at unique recommended data sets.

In the area of plasma interaction with surfaces, the Subcommittee endorses the initiation by the A+M data unit of a Coordinated Research Project (CRP) which aims at the evaluation of surface effects data.

In both cases, the Subcommittee should have the formal role to review the final recommended data, before they are released to the user community.

The final recommended data, resulting from these evaluations, are to be released to the user community by the IAEA in the most suitable and required formats (i.e. tape, print-out, book form, etc...).

In assisting with these evaluations by experts, the systematic collection of data by the IAEA may in some specific cases be a useful activity in preparation for obtaining recommended data.

E.2. Exchange Format

Emphasizing the fact that the co-ordination of evaluated A+M data evaluation is an important task of the IAEA A+M Data Unit at the present time, the Subcommittee made the following statement with regard to the development of an exchange format for A+M data.

Statement on the Exchange Format

The Subcommittee notes that in several A+M data centres computer formats have been developed or are under development for the storage and retrieval of A+M data, and that discussions on an exchange format between the A+M data centres have been started. The Subcommittee encourages these activities, particularly as they will eventually be needed in assisting in the evaluation of data and in the dissemination of recommended data to the fusion community.

E.3. A+M Data Priorities

In their consideration of the most important A+M data required by the fusion research community, the Subcommittee identified the following three reaction processes which should receive primary consideration:

- (i) Electron impact ionization,
- (ii) Electron excitation, and
- (iii) Electron capture.

The Subcommittee recommended (see Statement Regarding Numerical A+M Data) that the IAEA convene small experts meetings (consisting of approximately 5-10 experts), on each of the three priority topics with the specific objective to initiate a thorough evaluation of the data of these three reaction processes, and to produce a single set of recommended data for these processes. The names of the experts on each of these three topics, which were suggested by the Subcommittee, are given in Appendix 11.

F. IAEA Coordinated Research Programmes

The Subcommittee endorsed the two Coordinated Research Programmes (CRP) which have been initiated by the A+M Data Unit.

The first CRP on the "Evaluation of Atomic Data Pertinent to Plasma-wall Interaction Processes" is designed to produce a published compilation of the most recent and accurate data available for plasma-wall interaction processes. It was suggested by the Subcommittee that this CRP may lay the foundation for a future bibliographic index for surface effects data (see Section II.D.3. above).

The second CRP is on "Atomic Collision Data for Diagnostics of Magnetic Fusion Plasmas". The Subcommittee recommended that the effort in this CRP concentrate on the calculation and evaluation of the required data.

G. International A+M Data Centre Network

Discussions on the IAEA role in the international A+M Data Centre Network led to the following statement.

Statement on the International A+M Data Centre Network

Although no formal arrangement exists between the cooperating centres, two informal agreements have been reached at the second A+M Data Centre Meeting, (Fontenay-aux-Roses, May 1980), namely,

- to have an unrestricted exchange of bibliographic and numerical data between centres, and
- to cooperate in the development of a computerized data exchange format.

In addition to endorsing these agreements the Subcommittee encourages the following long-term arrangements:

- (i) to share a topical or regional responsibility in the collection and compilation of bibliographic and numerical A+M data to ascertain that all available data are compiled with a minimum of duplication,
- (ii) to share the responsibility to evaluate A+M data, either through the auspices of the IAEA or through bilateral agreements,
- (iii) to maintain an international list of data requirements and their priorities, and
- (iv) to establish regional responsibilities for providing services to the user community.

H. IAEA A+M Data Meetings

The Subcommittee reviewed all meetings held by the IAEA on the topic of A+M Data for Fusion and made specific recommendations as to their frequency.

- H.1. Technical Committee Meetings: larger meetings (50-100 participants) of the type held in Culham in November 1976 and at Fontenay-aux-Rose in May 1980. The frequency of these meetings should be 3 to 5 years depending on the development of the fusion technology.
- H.2. Specialists Meetings: small meetings of experts on specific topics (less than 10 participants). The proposed data evaluation meetings (see Section II.E.3. above) would fall in this category.
Frequency: at least one per year.
- H.3. Coordinated Research Programme Meetings: small topical meetings restricted to the participants and topic of the CRP. Each CRP has normally one meeting per year.
- H.4. International A+M Data Centre Network Meetings: meetings of the representatives of national and regional data centres participating in the collection, evaluation and distribution of A+M Data for Fusion. Frequency of these meetings was suggested to be every other year. Therefore, the next meeting of this data centre network was postponed till 1982.
- H.5. Meetings of the IFRC Subcommittee on A+M Data: members of this Subcommittee decided that meetings of this Subcommittee should take place after substantial progress has been made, but that the interval between meetings be no longer than 2 years.

IFRC Subcommittee on Atomic + Molecular Data for Fusion

Meeting 19-20 January 1981

List of Participants

(Members of the Subcommittee are marked by an asterisk)

- * Derrien, M.A. DEDR/DRNR/SEDC/SPNR
Centre d'Etudes Nucleaires
de Cadarache
B.P. No. 1
F-13115 Saint-Paul-Lez-Durance
- * Drawin, H.W. Dept. Phys. Plasmas & Fus. Contr.
Association Euratom-C.E.A. sur
la Fusion Controlee
Rue du Panorama, P.O.B. 6
F-92260 Fontenay-aux-Roses
- Gremillet, D. IAEA/Nuclear Data Section, A+M Data Unit
- * Harada, K. Division of Physics
Japan Atomic Energy Research
Institute
Tokai-Mura, Naka-Gun
Ibaraki-Ken 319-11, Japan
- * Harrison, M.F.A. Culham Laboratory
United Kingdom Atomic Energy Authority
Abingdon, Oxon. OX14 3DB
United Kingdom
- * Hayakawa, S. Institute for Plasma Physics
Nagoya University
Nagoya, Japan
- Katsonis, K. IAEA/Nuclear Data Section, A+M Data Unit
- Langley, R.A. IAEA/Nuclear Data Section, A+M Data Unit
- * Lorenz, A. IAEA/Nuclear Data Section
- Schmidt, J.J. IAEA/Nuclear Data Section
- * Stone, P.M. Applied Plasma Physics
Office of Fusion Energy
U.S. Department of Energy
Washington, D.C. 20545
U.S.A.

First Meeting

IFRC Subcommittee on A+M Data for Fusion

Vienna, 19-20 January 1981

Adopted Agenda

1. Introductory Items
 - Procedural Considerations
 - Selection of Chairman
 - Adoption of Agenda
2. Progress Report. Current status and plans of IAEA A+M Data Programme
3. Definition of Terms
4. Bibliographic A+M Data
 - A. A+M Data Bulletin
 - Suggested changes
 - Contributions from other centres
 - Creation of one common Bulletin
 - Structure and content of general part of the Bulletin
 - B. Surface Data Index
 - C. CIAMDA - future publication schedule
 - CIAMDA sales
5. Numerical A+M Data
 - A. Compilation of A+M collision data
 - Compilation scope and priority
 - Exchange format (briefing on EXFOR)
 - B. Considerations of evaluated A+M Data
6. Coordinated Research Programmes (CRP)
 - A. CRP on the "Evaluation of Atomic Data Pertinent to Plasma-Wall Interaction Processes"
 - B. CRP on "Atomic Collision Data for Diagnostics of Magnetic Fusion Plasmas"
7. A+M Data Centre Network
8. Future A+M Data Meetings
 - A+M Data Centre Network Meetings
 - Specialists Meetings
 - CRP Meetings
9. Summary of Actions, Conclusions and Recommendations of the Meeting

IFRC Subcommittee on Atomic + Molecular Data for Fusion

Terms of Reference

The International Fusion Research Council (IFRC) Subcommittee on Atomic + Molecular Data for Fusion will serve as a continuing Subcommittee within the framework of the International Atomic Energy Agency. Its function will be to review periodically the planning and execution of the Agency's Atomic + Molecular data programme and to advise the Director General on its direction in accordance with the needs of fusion reactor design.

Composition: the Subcommittee shall be composed of fusion and atomic scientists nominated by IFRC, and include the chairman of the International Nuclear Data Committee (INDC), or his nominee.

Methods of Work: the Subcommittee shall determine its own methods of work. The IAEA Nuclear Data Section shall provide the secretariat services to the Subcommittee.

Meetings: the Subcommittee shall be convened at a frequency not exceeding two years, and shall normally meet at IAEA Headquarters. The cost of participation of Subcommittee Members will be borne by the Government or sponsoring institute of the member. No interpretation will be required.

Approved by IAEA Administration
12.12.80

IFRC Subcommittee on Atomic + Molecular Data for Fusion

METHODS OF WORK

Under the Terms of Reference of the IFRC Subcommittee on Atomic and Molecular Data for Fusion (hereinafter referred to as the Subcommittee), as approved by the IAEA Administration on 12.12.80, the Subcommittee is authorized to determine its own Methods of Work.

I. Scope and Responsibilities

In addition to the general functions of the Subcommittee, stated in the Terms of Reference, the Subcommittee shall

- periodically review the IAEA programme on A+M Data for fusion
- review A+M data needs and recommend their priorities
- assist in specifying and planning topical A+M data meetings and coordinated research programmes
- assist in maintaining contacts between the IAEA A+M Data Unit and the fusion community
- assist in the coordination of A+M data centres

II. Organization

1. Chairman: the Chairman shall be a member of the Subcommittee and shall serve for one meeting. The responsibility of the Chairman shall remain in effect between meetings, until the following meeting, and he shall be kept informed by the Subcommittee members and the Scientific Secretary of relevant activities and developments.
2. Scientific Secretary: the Scientific Secretary shall be a staff member of the IAEA Nuclear Data Section, and shall serve as a member of the Subcommittee.
3. Membership: should it become necessary for a Subcommittee member to be relieved of his membership, it shall be his responsibility to arrange for his replacement in collaboration with the pertinent IFRC member, and to inform the chairman and the Scientific Secretary of the Subcommittee of the membership change in writing.

III. Meetings

1. Preparation: the preparation of the meetings shall be done timely by the Scientific Secretary of the Subcommittee in collaboration with the incoming and outgoing Chairman.
2. Frequency: the time between meetings of the Subcommittee shall be determined by progress in the field of fusion research and technology pertinent to A+M data and developments within the IAEA, but shall not exceed two years.
3. Proceedings: the proceedings of the meetings shall be written by the Scientific Secretary, and shall be issued as an IAEA report after having been approved by all Subcommittee members. The proceedings of every meeting shall be distributed to the IPRC and INDC committees, the A+M data centres and to the directors of all major fusion laboratories.
4. Observers: all meetings of the Subcommittee shall be open to observers.

IFRC Subcommittee on Atomic + Molecular Data for Fusion

Membership as of January 1981

Derrien, M.A.	INDC Chairman Representative	DEDR/DRNR/SEDC/SPNR Centre d'Etudes Nucleaires de Cadarache B.P. No. 1 F-13115 Saint-Paul-lez-Durance
Drawin, H.W.		Dept. Phys. Plasmas & Fus. Contr. Association Euratom-C.E.A. sur la Fusion Controlee Rue du Panorama, P.O.B. 6 F-92260 Fontenay-aux-Roses
Harada, K.		Division of Physics Japan Atomic Energy Research Institute Tokai-Mura, Naka-Gun Ibaraki-Ken 319-11, Japan
Harrison, M.F.A.		Culham Laboratory United Kingdom Atomic Energy Authority Abingdon, Oxon. OX14 3DB United Kingdom
Hayakawa, S.		Institute for Plasma Physics Nagoya University Nagoya, Japan
Lorenz, A.	Scientific Secretary	IAEA/Nuclear Data Section
Martynenko, Yu.V.		Institut Atomnoi Energii I.V. Kurchatova Ploshchad I.V. Kurchatova Moscow D-182, 123182 U.S.S.R.
Stone, P.M.	Chairman	Applied Plasma Physics Office of Fusion Energy U.S. Department of Energy Washington, D.C. 20545 U.S.A.

Current Status and Plans of IAEA A+M Data Programme

R.A Langley

The current staff of the Atomic and Molecular Data Unit of the Nuclear Data Section consists of 3 professional staff and 2 clerical staff. These are

R.A. Langley	Head of the Unit
K. Katsonis	Atomic physicist
D. Gremillet	Programmer
E. Lanka	Secretary
	Data processing clerk

R.A. Langley and D. Gremillet assumed their positions in the late summer of 1980 replacing F.J. Smith and J. Rumble. During the interim period K. Katsonis, with the help of M. Fichtner, maintained the bulletin production.

Since the Fourth Meeting of the Joint IFRC/INDC Subcommittee on Atomic and Molecular Data for Fusion nine Bulletins (6 through 14) have been published as well as CIAMDA 80. Sales of CIAMDA have lagged behind of what had been hoped for, but are currently increasing. (So far 116 copies have been sold).

It is anticipated that a supplement to CIAMDA will be published in 1982 with other supplements to follow at two year intervals or as required. However, this will depend on the CIAMDA sales.

In regard to the production of the bulletin, direct inquiries to users have resulted in positive suggestions to adjust its scope and to increase the number of journals searched. A large majority of the respondents were well satisfied with the present output format.

Future plans for the bulletin include using bibliographic input from the ORNL A+M Data Center and the NBS Atomic and Plasma Radiation Data Center as well as other data centers. Use of these inputs should increase the number of pertinent journals searched to an acceptable level. Review of the scope is now underway and changes will be made as necessary. The surface effects area will be expanded, while the spectra and collisions areas will be closely scrutinized to bring the bulletin output in agreement with the requirements of users and the A+M Data Centre Network participants. (See IAEA report INDC(NDS)-117/GA).

One of the goals of the A+M Data Unit is to create a data base of evaluated data and to disseminate these data to the users. To this end a Coordinated Research Programme has been initiated to review, evaluate and publish pertinent data relating to plasma-wall interactions. A report resulting from this effort will be designed so that plasma modellers will have easy access to the best existing (evaluated) data.

A coordinated research programme has been approved which will involve both developing and developed countries. This programme is designed to impact the analysis of data in present magnetic confinement plasma devices and the design of future fusion reactors through the measurement of most needed atomic collision cross sections.

A data storage and exchange format for numerical data (limited to atomic interaction data) is currently under investigation by the IAEA A+M Data Unit, while a data exchange format is being discussed by a committee set up at the second meeting of the A+M Data Centre Network (see INDC(NDS)-117/GA). Hopefully the results of these two efforts will arrive at a common numerical data exchange format which will be acceptable to all data centres.

DEFINITION OF TERMS

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 by one or more evaluators of all available data on a given topic (e.g. specific reaction for a given element), supplemented by theory or semi-empirical models, and the derivation of a consistent set of best or preferred values, possibly with their uncertainties.

Bibliographic Data: information related to the documentation of numerical data, consisting of the reference citation, publication status and indexation.

Numerical Data: a set of numerical values which falls into one of the following categories:

- Experimental data: numerical values resulting from a physics experiment (i.e. measurement)
- Calculated data: numerical values resulting from computation (e.g. calculated from theory)
- Derived data: numerical values calculated from data obtained in the analysis of experimental data (e.g. reaction rates calculated from reaction cross sections)
- Evaluated data: set of numerical values which have resulted from an evaluation (see above)
- Recommended data: set of numerical data, chosen by a recognized body to be recommended as the best set among a set of evaluated data.
- Standard data: set of numerical data established by general agreement as a basis for the measurement of other physical quantities, or set of accurately known data relative to which other data are determined (normalized)

Fusion Cut-Off Criteria for the
IAEA Bulletin Input

(Revision of original criteria published in
IPPJ-AM-15 (pp 11-13), Sep. 79)

TABLE I. CONSIDERED PROCESSES

1. Structure and Spectra

1. Spectral identification; Energy levels; Ionization potentials; Wavelengths
2. Transition probabilities; Oscillator strengths; Lifetimes
3. Broadening: Lineshapes and shifts
4. Polarisabilities; Electric moments
5. Interatomic potentials

2. Collisions

A. Involving photons

1. Total absorption, Scattering
2. Elastic scattering (Thomson, Rayleigh)
3. Inverse Bremsstrahlung
4. Photoionization
5. Photodetachment
6. Photodissociation

B. Involving electrons

1. Total scattering, momentum transfer
2. Elastic scattering
3. Excitation
4. Deexcitation
5. Ionization
6. Recombination
7. Attachment
8. Detachment
9. Dissociation
10. Bremsstrahlung

C. Between heavy particles

1. Total scattering
2. Elastic scattering
3. Excitation
4. Deexcitation
5. Ionization
6. Charge transfer
7. Detachment
8. Dissociation
9. Association
10. Interchange reactions

TABLE II. CLASSIFICATION OF PARTICLES AND ELEMENTS

(all ions of relevant atoms and molecules are included in each class)

<u>Class</u>	<u>Name</u>	<u>Constituents</u>
1	Photon	$h\nu$
2	Electron	e^-
3	Primary Atoms	H, D, T
4	Helium	He
5	Primary Molecules	H_2 , H_3 and variations with one or more H atoms replaced by D or T
6	Common Impurities	C, O, Ti, Cr, Fe, Ni
7	Impurities	B, N, Al, Si, V, Mo, W
8	Less Common Impurities	Li, Be, F, Ne, Na, Mg, P, S, Cl, Ar, K, Ca, Sc, Mn, Co, Cu, Zn, Kr, Zr, Nb, Ag, In, Xe, Cs, Ta, Pt, Au, Hg
9	Related Atoms	Ga, Ge, As, Se, Br, Rb, Sr, Y, Tc, Ru, Rh, Pd, Cd, Sn, Sb, Te, I, Ba, Hf, Re, Os, Ir, Tl, Pb
10	Molecules	H_2O , OH, H_3O^+ , O_2 , CO_2 , CO, He_2 , HeH, CH_4 , CH_3 , CH_2 , CH and variations with one or more H atoms replaced by D or T
11	All other Atoms or Molecules	

TABLE III. DATA TO BE ACCEPTED AS RELEVANT TO FUSION*

Class	3 Primary Atoms H, D, T <100%	4 Helium He <15%	5 Primary Molecules H ₂ , H ₃ ⁺ , D ₂ , etc. <5%	6 Common Impurities C, O, Ti, Cr, Fe, N, <5%	7 Other Impurities B, N, Al, etc. <<1%	8 Less Common Impurities Li, Be, F, etc. <<0.1%	9 Related Atoms Ga, Ge, etc.	10 Molecules H ₂ O, OH, etc. <<1%
1	E < 30 keV	E < 30 keV	E < 30 keV	E < 30 keV	E < 30 keV	E < 30 keV	E < 30 keV	E < 30 keV
2	E < 100 keV	E < 100 keV	E < 100 keV	E < 100 keV	E < 100 keV	E < 100 keV	E < 100 keV	E < 100 keV
3	E < 500 keV	E < 5 MeV	E < 500 keV	E < 500 keV	E < 500 keV	E < 500 keV	E < 500 keV	E < 500 keV
4	-	E < 5 MeV	E < 5 MeV	E < 5 MeV	E < 5 MeV	E < 5 MeV	E < 5 MeV	E < 5 MeV
5	-	-	E < 500 keV	E < 500 keV	E < 500 keV	E < 500 keV	E < 500 keV	E < 500 keV
6	-	-	-	E < 100 keV	None	None	None	None
7 - 11	None	None	None	None	None	None	None	None

* Provided that (1) the energy range includes values over 0.1 eV, and
(2) differential cross sections are over a wide range of angles.

Indexation Guideline for Surface Effects Data

1. Reflection (particles and energy)
 - a) e^-
 - b) Ions + Neutrals
2. Sputtering
3. Trapping + Detrapping (Diffusion)
4. Recombination (molecular)
5. Desorption (neutrals and charged)
6. Accomodation
7. Secondary e^- emission
 - a) by e^-
 - b) by ions + neutrals
8. Chemical Reactions
9. Blistering + Flaking

Organization of the Non-indexed Part of Bulletin

1. Structure (spectra)
2. Photon collisions
3. Electron collisions
4. Heavy particle collisions
5. Surface interactions (including arcing, evaporation, recycling and modelling)
6. Plasma diagnostics
7. Plasma compositions, impurities
8. Plasma heating, cooling and fueling (including pellet injection, gas injection, beam heating and RF heating)
9. Plasma theory (models)
10. Interaction potentials
11. Data bibliographics, progress reports

List of Suggested Experts for A+M Data Evaluation
(proposed by the IFRC Subcommittee on A+M Data)

1. Electron Impact Ionization

J.L. Crandall (ORNL)
K.T. Dolder (Newcastle)
G.H. Dunn (JILA)
U. Feldman (U.S. N.R.L.)
T. Kato (Nagoya)
H.J. Kunze (Bochum)
A.L. Merts (LASL)
D.L. Moores (Univ. Coll. London)
E. Salzbom (Giessen)

2. Electron Excitation

J.A. Duban (Mendon)
T. Kato (Nagoya)
A.L. Merts (LASL)
D.H. Sampson (Penn State)
H. Summers (Glasgow)
L.A. Vainshtain (Lebedev)
S. Younger (NBS)

3. Electron Capture

P. Benoit-Cattin (Toulouse)
S.L. Bliman (Grenoble)
F.J. de Heer (Amsterdam)
R.F. Janev (Belgrade)
R.E. Olson (SRI)
H. Ryufuka (JAERI)
A.S. Schlachter (Berkeley)