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INTERNATIONAL NUCLEAR DATA COMMITTEE

**IAEA Technical Committee Meeting:
10th Meeting of the IFRC Subcommittee on
Atomic and Molecular Data for Fusion**

27-28 May 1998, Vienna, Austria

SUMMARY REPORT

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January 1999

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

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Abstract

This report describes briefly the proceedings and the conclusions and recommendations of the 10th Meeting of the Subcommittee on Atomic and Molecular Data for Fusion of the International Fusion Research Council held on May 27-28, 1998 at the IAEA Headquarters in Vienna, Austria. The report includes also the Executive Summary of the Subcommittee from this Meeting which was communicated to the IAEA Director General, and is appended with the Report on Activities of IAEA A+M Data Unit for the period July 1996 - May 1998.

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1. INTRODUCTION

The 10th Technical Committee Meeting of the Subcommittee on Atomic and Molecular (A+M) Data for Fusion of the IAEA International Fusion Research Council (IFRC A+M Subcommittee) was held on May 27-28, 1998 at the Agency Headquarters in Vienna. The main objectives of the meeting were to review and assess the Agency activities in the area of A+M/PMI (plasma-material interaction) data for fusion in the period since its last meeting in July 1996 and provide recommendations to the Agency regarding its future programmes in this area. This Agency's activity is carried out within the IAEA Nuclear Data Section by the Atomic and Molecular Data Unit.

The meeting was attended by eight (out of ten) Subcommittee members (see [Appendix 1: List of participants](#)). At the beginning of the year Dr. V. Abramov, a long time Subcommittee member has passed away, and Dr. D. Post, a second representative from the USA, has changed meanwhile the field of its scientific activity. Apart from Dr. R.K. Janev, the Head of A+M Data Unit who also serves a secretary to the IFRC A+M Subcommittee, the meeting was attended also by Dr. J.A. Stephens, the other professional staff member of the A+M Data Unit. Working materials for the meeting, including the written version of the Report on the Activity, were prepared by the A+M Data Unit staff and were distributed to the participants before the start of the meeting.

2. BRIEF MEETING PROCEEDINGS

The meeting was opened by the IFRC A+M Subcommittee Chairman, [Dr. R. McKnight](#), who noted the absence of Drs. V. Abramov and D.E. Post at the meeting and in the Subcommittee membership, and welcomed [Prof. N. Peacock](#) as new Subcommittee member representing the United Kingdom. After short self-introduction of the Subcommittee members, the meeting was addressed by [Dr. D.W Muir](#), Head of the IAEA Nuclear Data Section, who welcomed the meeting participants and suggested some expected (desirable) outcomes from the meeting regarding the 1999-2000 and 2001-2002 strategies and programme and budget plans for this Agency activity. After the official opening, the meeting proceeded its work in accordance with the adopted agenda (see [Appendix 2: Meeting Agenda](#)).

In the first meeting session, the Head of the IAEA A+M Data Unit briefly presented the Report on the IAEA Activities in the area of atomic, molecular and plasma-material interaction (A+M and PMI) data for fusion in the period July 1996-May 1998 (see [Appendix 3](#)). The report addressed the following broad areas of the A+M Data Unit activities: Co-ordinated Research Projects (CRPs), co-ordination of the A+M Data Centre Network (A+M DCN) activities, development of the IAEA Atomic and Molecular Data Information System (AMDIS) and the ALADDIN numerical database, storage and exchange system, status of the IAEA bibliographic A+M Data Bulletin and of the IAEA Series on Atomic and Plasma-Material Interaction Data for Fusion (the APID Series), experts meetings organised during the reporting period, interaction of the A+M Data Unit with the fusion and A+M/PMI physics

communities, the programme plans for 1999-2000 and the programme projections for the 2001-2002 period.

After the presentation of the Report a general discussion took place on the overall activity of the A+M Data Unit, the conditions under which this activity has been carried out in the reporting period (especially the effects of the loss of one P-4 position from the Unit and of the financial constraints), the overall effectiveness and accomplishments of the Unit activity, including its adherence to the programmatic directions recommended by the Subcommittee at its previous meetings. It was noted that the negative effects of the loss of the P-4 position from the Unit have been partly compensated by an extensive use of consultant services in this period. The overall effectiveness and accomplishments of the Unit activity were characterised as outstanding. The efforts of the Unit to bring the data closer to the users (development of the on-line access to the data via Internet) and to accommodate an extrabudgetary activity within the programme (establishment of an International Database on Irradiated Nuclear Graphite Properties) were assessed as particularly positive. The role of the IAEA A+M Data Unit staff in the establishment of the International Conference on Atomic and Molecular Data and Their Application (ICAMDATA) and in the work of the 1st ICAMDATA (Gaithersburg, September 1997) was also appreciated as highly important. Further participation of the Unit staff in the work of IAMDATA and in other A+M physics and fusion related international conferences was strongly recommended by the Subcommittee.

In Session 2, the meeting participants discussed the status of the work and collaboration within the A+M Data Centre Network. Despite of some financial difficulties in the support of the work of certain national data centres, the intensity of the work of the A+M/PMI data centres, collaborating within the A+M Data Centre Network (DCN), is still remarkable and responds adequately to the fusion A+M data needs. The expansion of the A+M DCN by new data centres (Weizmann Institute, Rehovot; KAERI, Taejon; IPP Garching; TITI, Troitsk) was noted by the Subcommittee with satisfaction. The increase of the volume of programmatic activity of the A+M DCN and of the degree of interaction and collaboration within the Network are signs of the positive co-ordinating role of the A+M Data Unit and a result of the developed tools for electronic communication and data exchange.

The role of the A+M Data Unit and of the entire A+M/PMI DCN in the work of ICAMDATA conferences could be very important and beneficial for all. Strong involvement of both A+M Data Unit and the A+M/PMI DCN in the ICAMDATA structure and meetings is, therefore, strongly recommended.

A review of the present and near future A+M/PMI data needs for fusion research and reactor design work, as well as of the priorities in the related IAEA programmes, were carried out during sessions 3 and 4 of the meeting. After an extensive discussion it was concluded that the most of the fusion A+M/PMI data needs are currently related to the description, modeling and diagnostics of edge plasma phenomena (edge plasma behaviour and dynamics), the plasma interaction processes with the plasma facing materials and the behaviour, response and properties of plasma facing materials exposed to high heat and particle fluxes in the divertor region. These needs are currently fairly adequately covered by the ongoing Agency co-ordinated research projects (CRPs), the activity of experts' groups (meetings and individual

research contracts) and of the A+M/PMI DCN. The Subcommittee, however, takes note that elementary processes in dust plasmas (presently under active investigation) could also be considered as a prospective area for focused data efforts. Another such area would be, in the Subcommittee's opinion, the A+M and PMI data needs for modeling and diagnostics of localised high-energy density plasma phenomena, such as current termination (plasma disruptions) and giant ELMs. An Advisory Group Meeting (AGM) was strongly recommended to be held in the near future to explore the necessity, scope and the form of a potential long-term Agency activity in this area. Such an activity could be also linked to the A+M data needs in the inertial confinement fusion (ICF) (e.g. laser-material interactions). In order to explore in more detail the data needs in ICF research, the Subcommittee has invited Dr. T. Dolan (Head of the IAEA Physics Section) to provide more information on the status of Agency activities in the IFC area. In order to accommodate the identified A+M/PMI needs of the fusion energy research in the IAEA programmes for 1999-2000 and 2000-2001 periods, several other activities were recommended by the Subcommittee, which are reflected in Section 3 of the present Report and in the Attachments A and B of Section 5.

Regarding the priorities of the A+M Data Unit activities, besides those related to the database establishment programmes (e.g. via CRPs, the A+M/PMI DCN, separate Data Unit database related efforts), the further development of the on-line accessibility of the IAEA numerical A+M/PMI databases for fusion should be among the highest priorities. Direct and user-friendly access to the AMDIS databases via WWW, without using a telnet session, should be the objective of this development.

The Subcommittee also discussed the Agency proposed to separate the Series on "Atomic and Plasma-Material Interaction Data for Fusion" (APID Series) from the journal "Nuclear Fusion", to which the annual volumes of the series were designated as supplements. The Subcommittee endorsed the change of the status of the APID series, but expressed concerns about the international profile of the series and potential loss of the professional recognition for the contributors. These concerns were found to be not well founded in view of the already gained popularity of the series among the data users. The Subcommittee nevertheless strongly recommended that the "Nuclear Fusion" journal makes a "pointer" to the APID Series in its WWW homepage. Subcommittee also recommended that the Agency makes available the necessary funds to ensure implementation of the APID-Series publication plans for 1998-1999, and beyond. Further, in order that the APID series fulfils its basic function (quick data related information transfer to fusion and A+M/PMI researchers), the Agency should distribute cost-free a number of copies to colleagues from the fusion and A+M/PMI communities which would mostly benefit from the information contained in a specific volume of the series.

The Subcommittee took note that the first term of service (5 years) of the members of the International Editorial Board for the APID Series has already expired, that some of the Board members have meanwhile either retired or changed the field of their activity and, consequently, a reconstruction of the Board membership is required. The Subcommittee Chairman was charged to take an action in this regard. During its Session 5, the Subcommittee discussed some business matters. The Subcommittee Chairman, in co-operation

with the Secretary, took the responsibility to take the necessary actions regarding the new Russian and the second US representative in the Subcommittee. In view of the expected extension of the ITER EDA for additional three years, and to meet the needs of the Agency programme and budget planning process for the years 2001-2002, the Subcommittee decided to convene its next meeting in late April or early May 1999. Such a rescheduling of the biennial Subcommittee meetings would be in better conformity with the two-year cycle planning process of the Agency.

The Subcommittee Chairman has announced his resignation from the Subcommittee at the next meeting in 1999. Other Subcommittee members have also announced their retirements from the employing organisations during 1999.

It was also suggested that in future the report on the IAEA A+M/PMI data activities be submitted to the Subcommittee members at least one month before the meeting dates. During the last meeting session (Session 6), the Subcommittee formulated its conclusions from the deliberations and its recommendations to the Agency regarding its A+M/PMI data activity, as well as the basic elements for an Executive Summary of the Meeting to be transmitted to the Agency authorities and the IFRC. The outcomes of this session are given in Sections 3 and 4 of the present report.

3. MEETING CONCLUSIONS AND RECOMMENDATIONS

The discussions of the IAEA A+M/PMI data activities as reflected in the Report of the A+M Data Unit for the period July 1996-May 1998, and the data needs analysis of the present fusion programme discussed in a broader context and prospective, have led to the following conclusions:

- 1) The development of fusion energy research, which has entered into a stage of engineering design of reactor level installations and operation of experimental devices with reactor relevant plasma performance parameters and system components, continues to demonstrate the important role of A+M and PMI data for its further progress towards the accomplishment of the final goal. The critical design and operation issues of power and particle exhaust, optimisation of the divertor performance, adequate behaviour and properties of plasma facing components and materials, all require detailed (in many cases still not available) information on the atomic, molecular and plasma-material interaction processes, as well as on the thermo-mechanical and other properties of plasma facing materials. The generation, collection and critical assessment of this information is, therefore, an important task for the further fusion energy development and an essential input to the design and plasma analysis codes.
- 2) The IAEA role in the co-ordination of world-wide efforts on establishment of comprehensive and high-quality numerical A+M and PMI databases for the needs of fusion energy research appears to be presently (and in the past) unique and irreplaceable. Through its specific mechanisms of activity in this field (the system of CRPs, co-

ordination of the work of A+M/PMI Data Centre Network, the system of experts' meetings), the IAEA puts together the world expertise in this field, focuses, directs and stimulates the A+M/PMI data generation efforts, consolidates the past and present results of this efforts, and establishes the required databases in formats suitable for use in fusion applications and easily accessible via the modern electronic communication media (Internet, WWW, etc). This approach to the A+M/PMI data needs of the international fusion programme guarantees the highest quality of the resulting databases, effectiveness in their establishment and avoids duplication of the efforts.

- 3) The Atomic and Molecular Data Unit of the IAEA Nuclear Data Section has been carrying out the A+M/PMI data activities of the Agency with an outstanding competence, professionalism and efficiency during the last decade. The strong interaction of the Data Unit with both the fusion and A+M/PMI physics communities, its well defined, focused and organised programmatic and co-ordinating activities (involving, on average, co-operation of more than 40 leading research laboratories per year and an A+M/PMI Data Centre Network with about 15 members) and the significant impact of these activities on the fusion (including ITER EDA) and A+M/PMI physics research, have resulted in their high recognition and appreciation by both the fusion and A+M/PMI communities. The high professional standards and intensity of the work of the A+M Data Unit were maintained also during the July 1996-May 1998 reporting period.
- 4) The A+M Data Unit has carried out in the reporting period an outstanding work. The Unit's programme has been executed in line with the Subcommittee recommendation given at its previous meetings. Among the highlights of the A+M Data Unit activities in the reporting period are:
 - Successful completion of the CRPs on the "Radiative Cooling Rates of Fusion Plasma Impurities" and "Collection and Evaluation of Reference Data for Thermo-Mechanical Properties of Fusion Reactor PFCs", the results of which will be published as separate volumes of the IAEA APID series in 1999;
 - Initiation of two new CRPs on "Charge Exchange Cross Section Data for Fusion Plasma Studies" and "Plasma-Material Interaction Data for Mixed Plasma Facing Materials in Fusion Reactors" in which the best world experts in the respective fields were included as participants;
 - Expansion of the A+M/PMI Data Centre Network by new members and strengthening the work co-ordination within the Network;
 - Establishment of two new comprehensive numerical databases on "Particle induced erosion of Be, C and W in Fusion Plasmas" (in collaboration with the participants of the CRP on the "Erosion Rates of Plasma Facing Materials", terminated in 1996) and "Elastic and related transport cross sections for collisions among isotopomers of $H^+ + H$, $H + H$, $H^+ + H_2$, $H + H_2$ and $H^+ + He$ " (in collaboration with the ORNL A+M Data Centre CFADC);
 - Creation of the A+M Data Unit's WWW Homepage for providing direct Internet access to the IAEA AMDIS databases.

Besides the above, the Unit has continued with its normal publication activity on the International Bulletin on A+M Data for Fusion and organised 8 experts' meetings.

- 5) The proposed programmatic plans for the periods 1999-2000 and 2001-2002 adequately reflect the priorities in the A+M/PMI data needs of the future (near- and long-term) fusion programme and are in accordance with the general recommendations given at the previous Subcommittee meetings. In its deliberations, however, the Subcommittee identified places for certain minor modifications and additions to these plans, as summarised in the recommendations below and in the Attachments A) and B) of Section 5 of this report.
- 6) The Subcommittee recognises and endorses the efforts of the A+M Data Unit to extend its activity in plasma science and other related areas outside the fusion energy programme and to increase the usefulness of AMDIS databases in other science and technology areas. The initiation of the extrabudgetary programme on the establishment of an international database on irradiated nuclear graphite properties and the active participation of the Data Unit in the organisation and the work of 1st ICAMDATA Conference are positive steps in that direction.
- 7) The Subcommittee took note with satisfaction that its earlier recommendations to the Nuclear Data Section and higher Agency authorities to enhance the computer equipment base for the A+M/PMI data activities and compensate the manpower loss in the Unit by consultant services have been effectively implemented.

SUBCOMMITTEE RECOMMENDATIONS AND ENDORSEMENTS

1. The Subcommittee endorses in general the implementation of the programme of IAEA A+M/PMI activities for 1999-2000 recommended at its 9th meeting in 1996. The Subcommittee, however, recommends that the following modifications are made in the programme at an appropriate stage (e.g. during the programme review at the end of 1999):
 - a) **Task G.1.04/3:** The Subcommittee recommends that this activity be extended into the 2001-2002 time period, with an added RCM in 2002 and a completion date to 2004;
 - b) **Task G.1.04/4:** The Subcommittee recommends that this activity be continued into the 2001-2002 time period and that in preparation of this extension a TCM be organised in 2000 to define the size and content of extended activity;
 - c) **Task G.1.04/8:** The Subcommittee recognises a need for enhanced activity in this area and recommends organisation a TCM in 2000 to define the scope and participants of a CRP on the subject. It is recommended that this CRP be initiate already in 2000 with a duration until 2004.

These changes in the 1999-2000 programme of A+M/PMI data activities are indicated in the Attachment A of Section 5.

- d) The Subcommittee strongly recommends that the Agency organize an AGM (if financially feasible) or a TCM during the 1999-2000 period on the A+M/PMI data for modeling and diagnostics of localized high-energy density plasma phenomena.
2. The Subcommittee reviewed the proposal of IAEA A+M Data Unit for the programme of activities for the 2001-2002 time period. In connection with this programme, the Subcommittee
 - a) endorses (mutatis mutandis) the continuing activities contained in the projects G1.01, 02 and 05 from the period 1999-2000;
 - b) endorses the proposed tasks T.1-T.3, T.5, T.7-T.9, T.11 of the project G.1.04 (see Attachment B in Section 5);
 - c) strongly recommends the inclusion in the programme of two new tasks (T.4 and T.10) and the continuation of the activity on tritium retention and release database (task T.6).

The Subcommittee recognises that the recommended activities for the period 2001-2002 are dependant on availability of funds and recommends that such funds be made available.

- 3) The Subcommittee endorses the separation of IAEA APID Series from the "Nuclear Fusion" journal. Considering that this series is of paramount importance for exchange of significant amounts of both physical and numerical information between the A+M/PMI and fusion research communities, the Subcommittee recommends to keep the publication of this series high on the priority list of IAEA A+M/PMI data activities and to ensure the necessary funds for its regular publication. Despite of the fact that the volumes of this series are treated as priced publications, the Subcommittee strongly recommends that the Agency ensures that a sufficient number of copies of each volume be distributed cost-free to the relevant researchers in the fusion and A+M/PMI communities, including the volume contributors, members of the A+M Data Centre Network, Editorial Board members and the A+M Subcommittee members. It is also strongly recommended that the "Nuclear Fusion" journal provides space in its volumes for effective advertisement of the series and a pointer in its WWW homepage to the APID Series.
- 4) The Subcommittee considers essential that the A+M/PMI numerical data stored in the ALADDIN/AMDIS databases and resulting from a well co-ordinated world-wide effort be disseminated to the users (the fusion research, A+M/PMI physics and other science and technology communities) as quickly as possible and in an electronic way which provides an easy and user-friendly access to the data. For this purpose the Subcommittee strongly recommends that the IAEA A+M Data Unit implement and maintain its own Website for dynamic access to the ALADDIN/AMDIS databases. Besides enabling a rapid deployment of the data, this development would make an effective use of Web and database software and ensure its compatibility with that of the majority members of the A+M/PMI Data Centre Network. Such approach would also

help to implement the earlier recommendation of the Subcommittee for mirroring of ALADDIN databases at certain preselected (ORNL and JAERI) data centres.

The Subcommittee also recommends that the ALADDIN Website design contains all the necessary graphics, and a direct link to the A+M Data Unit Homepage.

- 5) The Subcommittee recommends that the existing collaboration within the A+M/PMI DCN be further strengthened in the field of electronic data exchange and database mirroring. This obviously requires an appropriate co-ordination in the future developments of the Website and database software within the entire Data Centre Network.
- 6) The Subcommittee endorses the recent strong involvement of the A+M Data Unit in the work and organisation of ICAMDATA, ICPEAC, and in certain fusion related meetings and conferences where the fields of A+M or PMI data and processes appear as important conference (or meeting) topics. The Subcommittee strongly recommends the continuation of this activity (task G.1.05/11) in the future, as an appropriate means for strengthening the interaction of A+M Data Unit staff with the relevant communities of data producers and data users and for promotion the IAEA A+M/PMI databases and activities.
- 7) The Subcommittee endorses the involvement of the A+M Data Unit in extrabudgetary Agency programmes, where the Unit's expertise and technical base are found to be useful. The extent of such activities should not, however, adversely affect the implementation of the programmes related to the basic mission of the A+M Data Unit.
- 8) Because of the need to adjust the two-year cycle of the Subcommittee meetings with the Agency's two-year programme and budget planning cycle, for which the Subcommittee meetings provide an input, the Subcommittee decides to hold its next, 11th meeting at the end of April or beginning of May in 1999. The two-year interval between the Subcommittee meetings will be retained thereafter.

The A+M Data Unit is requested to prepare and distribute its report on activities to the Subcommittee members one month before the meeting. This rule shall be exercised also in the future.

4 EXECUTIVE SUMMARY (Prepared by R. McKnight)

IAEA Technical Committee Meeting:

10th Meeting of the IFRC Subcommittee on Atomic and Molecular Data for Fusion

27-28 May 1998

IAEA Headquarters

Executive Summary

The IFRC Subcommittee on Atomic and Molecular Data for Fusion met at IAEA Headquarters in Vienna on May 27-28, 1998. In attendance were members R. McKnight (Chairman), N. J. Peacock, M. Mattioli, E. Menapace, J. Roth, T. Shirai, and H. Tarawa and from the Agency, R. Janev and J. Stephens. The Subcommittee noted with sincere regret the absence of V. A. Abramov, a long time member of the Subcommittee who died unexpectedly in February. Doug Post of the USA who is no longer working in the fusion has also left the Subcommittee. Doug Muir welcomed the Subcommittee and discussed the role the subcommittee played in the biannual planning carried out by the Agency. His comments were welcome and clearly stated for the Subcommittee the importance of their recommendations to the agency. His discussion of the Agency budgeting process provided useful information about the timing of our meetings.

Each meeting of the IFRC Subcommittee on Atomic and Molecular Data for Fusion brings to the IAEA headquarters an international group of members. The unique nature and international importance of the Atomic and Molecular Data Unit at the IAEA is reinforced with each new report of activity presented by Agency staff. Only an organization like the IAEA can assure open access to and participation in data activities and the Subcommittee supports in the strongest possible terms continued support for this important IAEA activity. The outstanding work carried out by the Data Unit in coordinating world-wide data centers is consistent with and reinforces the inherently international aspect of the IAEA. This activity is very important in support of the development of fusion energy, both for existing experiments and for future systems which are under construction or being planned. There is an increasing dependence on computational and modeling in fusion, and quality data are critical components of these calculations. It is also clear that there is increasing use by other scientific and technical researchers of data generated and consolidated for fusion.

The Subcommittee recognizes the excellent effort by the Atomic and Molecular Data Unit carried out over the last two year period of activity. The level of productivity and effectiveness in carrying out the Data Unit mission has remain consistently high despite very tight budget and staffing conditions. The written report of activities was complete and the verbal presentations by Data Unit staff contributed positively to the report. The Subcommittee recommends that the written report of activity be distributed to members at least one month before the meeting to allow more time for detailed reading. The accomplishments during the last two years are too extensive and varied to recognize individually in this report. We thank the agency for responding positively to our recommendation regarding computer technology for the Atomic and Molecular Data Unit and note with satisfaction the development of a useful Internet site for the data unit. We urge the Agency to continue the development of this site and to assure that it is made "user friendly".

It is encouraging to hear of the increased professional activity of the Data Unit staff outside of the agency, an action that the Subcommittee has recommended in the past. This not only raises the visibility of the data center, but allows communication about data needs with a broader scientific community than that represented in normal Data Unit activities. Data Unit staff helped organize and participated in the International conference on Atomic and Molecular Data and Their Applications, held at the National Institute of Standards and Technology. The report of this meeting, presented to the Subcommittee, showed clearly the importance of reliable atomic and molecular data in many different areas of science and technology and offered opportunity for coordination and information exchange outside the fusion area.

The extraordinary project on irradiated graphite data represents a recognition of the quality data efforts carried out by the Data Unit and the Subcommittee commends the Unit for this effort.

The Subcommittee notes and endorses the change in status of the APID-series, that is the separation of the series from Nuclear Fusion. While the rationale presented for this change is reasonable, the Subcommittee voices concern about loss of professional recognition for authors in the APID series with this action. It is important that the APID series continue, and the Subcommittee strongly recommends that a page be included in appropriate Nuclear Fusion issues to act as a "pointer" to APID series when published. We also recommend that funds be made available for 1998 for implementation of APID and CIAMDA publication plans presented during the meeting due to the exceptional circumstances represented by the status of the different issues and volumes.

The Subcommittee discussed the program Plan for 1999-2000 which was approved by the Subcommittee in the 1996 meeting. We endorse this plan and offer several recommendations and comments. We also recognize that our specific recommendations of new meetings and activities beyond the 1999-2000 program are dependent on availability of funds and recommend that these funds be made available. (The references are to Attachment 11 of the Data Unit report which is attached.)

Within the program plan for 1999-2000, there are several recommendations.

For project G.1.04:

T.3. Coordinate a CRP on plasma-material interaction data for mixed plasma facing materials.

The Subcommittee recommends that this activity be extended into the 2001-2002 time period with an added RCM in 2002 and an extended completion date to 2004. This is an important area for fusion experiments as more emphasis is placed on edge and particle and power handling concerns.

T4. Critical assessment of the tritium retention in fusion reactor materials.

The Subcommittee recommends that this work be continued into the 2001-2002 time period and that in preparation for this extension, a TCM, without agency support, be organized

for 2000. This area is one where the use of consultants would be particularly productive.

T.8. Initiate a CRP on A+M data for fusion plasma diagnostics.

This activity ties into continuing work in 2001-2002. However, the Subcommittee recognizes a need for enhanced activity in this area and recommends a TCM, without agency support, in 2000.

The following recommendations are made for proposed program plan for 2001-2002.

The Subcommittee endorses continuing activities G.1.01, 02 and 05. In addition, for project G.1.04, the Subcommittee endorses the proposed tasks T.1, T.2, T.3, T.5, T.7, T.8, T.9 and T.10. In addition, three new activities are recommended.

T.4. Initiate CRP on collisional data for molecular impurities in the plasma edge. Related actions include a CM in 2001, and the first RCM in 2002, with an anticipated completion date of 2005.

T.6. Review and upgrade the data base on tritium release retention and release. Recent concerns in the fusion community about the importance of dust in fusion devices should be considered. Related activities include an AGM in 2001 and a completion date of 2002.

We also strongly recommend a new activity which is an AGM to determine Atomic and Molecular and Plasma Material Interaction data needs for modeling and diagnostics for localized high energy density plasma phenomena such as current terminations and giant ELMs. We recognize that these data needs may be of interest in other areas such as laser-material interactions.

In a related issue, there was discussion of the need to reconstruct the APID-series editorial board. The present board was nominated 5 years ago and because of significant losses from the original board of editors due to retirements and other professional changes, it is clear that there will be a substantial number of new members. It was decided that the Subcommittee chair will draft a letter which will be distributed to present members about their continuing membership and that the Subcommittee will work by electronic communication in assembling a new board for the next 5 year period.

With regard to Subcommittee business, it was decided that the next meeting would be held in April or early May of 1999 and that at that time, the selection of a new chairman, which was tabled at this meeting, will be carried out. This shift to an earlier meeting and into a different two year cycle will allow our report to be used more effectively during the Agency budgeting activity.

5. ATTACHMENTS

Attachment A

A+M DATA UNIT PROGRAMME PLAN FOR 1999-2000

Tasks Planned for 1999 -2000	Related Action	Completion
<u>Project G.1.01 : Data Centre Activities</u>		
T.1. Operate computers, maintain hardware (i.e. IBM RISC 6000: RS E-30, PCS) and provide on-line services (joint task with the rest of NDS)	CS '99, 2000	Continuing
T.5. Maintain A+M databases (atomic, molecular, plasma-material interaction data) in AMDIS	CS '99, 2000	Continuing
T.10. Hold 11 th Meeting of IFRC Subcommittee on A+M data for fusion (biennial review of A+M data programme)	TCM 2000	2000-2001
<u>Project G.1.02 : Data Network Co-ordination</u>		
T.3. Hold co-ordination meeting of A+M Data Centre Network (biennial)	AGM '99	Continuing
T.6. Maintain A+M manuals and documentation (ALADDIN and AMDIS)		Continuing
T.7. Co-ordinate A+M Data Centre Network (joint data management software and evaluation programmes)		Continuing
T.9. Maintain CIAMDA database (computer index of A+M bibliographic data)		Continuing
T.10. Publish the International Bulletin on Atomic and Molecular Data for Fusion (two volumes per year)		Continuing (semiannually)
<u>Project G.1.04 : Establishment of A+M/PMI databases</u>		
T.1. Co-ordinate a CRP on atomic and plasma-wall interaction data for fusion reactor divertor modeling (1995-2000). Publish a report in 2001	RCM 99 CS 2000	2000 2001
T.2. Co-ordinate a CRP on charge exchange data for fusion plasma studies (1997-2000)	2nd RCM 2000	2001
T.3. §Co-ordinate a CRP on plasma-material interaction data for mixed plasma facing materials (1997-2000) [to be extended]	2nd RCM 2000	2004
T.4. §Review status and requirement for tritium retention in fusion reactor materials. [Critical assessment of tritium retention data]	AGM 99 [TCM 2000]	2000 [2002]
T.5. Review and upgrading of the electron-impact collision data for selected plasma impurities	CS 99	2000
T.6. Prepare and publish Nuclear Fusion A+M Supplement	Vol. 10, 1999 Vol. 11, 2000	Continuing
T.7. Collect and assess atomic and particle-surface interaction data	CS 99, 2000	Continuing
T.8. §Co-ordinate a CRP on A+M data for fusion plasma diagnostics (2000-2003) [including fusion alpha particle diagnostics]. [Initiate the CRP in 2000]	[2000 TCM]	2003 [2004]
T.9. *Co-ordinate the establishment and maintain Intern. irradiated graphite database	CM 99, 2000 [RCM ~ CM]	Continuing
<u>Project G.1.05 : Data User Support and Promotion</u>		
T.2. A+M on-line system development and enhancement of WWW service capabilities	CS 99, 2000	Continuing
T.11. Participation in the work and organization of ICPEAC and ICAMDATA Conferences	ICPEAC '99 ICAMDATA '00	Continuing

* Extrabudgetary programme (in negotiation stage)

§ Extension beyond year 2000 recommended by IFRC A+M Subcommittee

[] denotes recommended changes

**Proposed A+M/PMI Data Programme for the IAEA A+M/PMI
Data Activities for the 2001-2002 Period**

Tasks Planned for 2001-2002	Related Action	Completion
Project G.1.01: Data Centre Activities* Project G.1.02: Data Network Co-ordination* Project G.1.05: Data User Support* * All tasks from the 1999-2000 programme remain (mutatis mutandis)		
<u>Project G.1.04: Establishment of A+M/PMI Databases</u>		
T.1. CRP on charge exchange data for fusion plasma studies. Final report editing and publication	CM 2001	2002
T.2. CRP on plasma-material interaction data for mixed materials	RCM 2002	2004
T.3. Co-ordinate CRP on A+M data for fusion plasma diagnostics	1st RCM 2001	2004
T.4. *Initiate CRP on collisional data for molecular impurities in plasma edge (including dust particles)	CM 2001 1st RCM 2002	2005
T.5. *A+M/PMI data for fusion reactor technology (and publish proceedings)	TCM 2001	2002
T.6. *Review and upgrading of the database for tritium retention and release in fusion reactor materials	AGM 2001	2002
T.7. Prepare and publish APID volumes	vol. X 2001 vol. Y 2002	Continuing
T.8. Collection and assessment of A+M/PMI data	CS 2001 CS 2002	Continuing
T.9. Review and upgrading databases for selected A+M/PMI processes	CM 2001 CM 2002	
T.10. *AGM on A+M/PMI data for modeling and diagnostics of localised high-energy density plasma phenomena	AGM 2001	
T.11. #Establishment of int. irradiated nuclear graphites database	CM 2001 CM 2002	

*: New; #: extrabudgetary programme

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**IAEA Technical Committee Meeting:
10th Meeting of the IFRC Subcommittee on
Atomic and Molecular Data for Fusion**

27-28 May 1998, IAEA Headquarters, Vienna, Austria

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Appendix 2

IAEA Technical Committee Meeting: 10th Meeting of IFRC Subcommittee on Atomic and Molecular Data for Fusion

27-28 May 1998, IAEA Headquarters, Vienna, Austria

Meeting Agenda

Wednesday, 27 May

Meeting Room: C-0249

09:30 - 10:00 Opening
 Adoption of Agenda

Session 1: Review of IAEA A+M/PMI Data Activities

10:00 - 10:30 Report on IAEA A+M/PMI Data Unit activities since the last
 Subcommittee meeting

10:30 - 11:00 Discussion of the Report: status of main IAEA A+M/PMI data
 programmes and their position within the Agency

11:00 - 11:30 *Coffee break*

11:30 - 12:30 Programme implementation assessment

12:30 - 14:00 *Lunch*

**Session 2: A+M Data Centre Network and other International A+M Data
 Related Activities**

14:00 - 15:00 Programme coordination of A+M Data Centre Network activity

15:00 - 15:30 ICAMDATA Conference: relevance and implications for IAEA A+M
 data activities

15:30 - 16:00 *Coffee break*

Session 3: Review of Fusion A+M/PMI Data Needs (Current and Future)

16:00 - 17:30 A+M/PMI data needs of current and planned fusion experiments
 (including extended (?) ITER EDA and inertial confinement
 programme)

17:30 - 18:00 A+M/PMI data needs in other plasma application fields: potential role
 of A+M data centres

Thursday, 28 May

Session 4: Near- and Long-Term Priorities in A+M/PMI Data Activities

- 09:00 - 10:00 General near- and long-term priorities areas for the IAEA and A+M Data Centre Network
- 10:00 - 11:00 IAEA A+M/PMI programmes for 1999-2000 and 2001-2002 periods (CRPs, meetings, publications, AMDIS development)
- 11:00 - 11:30 *Coffee break*
- 11:30 - 12:30 Priorities in Data Centre Network activities for the 1999-2000 period, and beyond
- 12:30 - 14:00 *Lunch*

Session 5: Business Matters

- 14:00 - 15:00 Subcommittee membership; election of new Subcommittee Chairman
- 15:00 - 15:30 *Coffee break*

Session 6: Meeting Conclusions and Recommendations

- 15:30 - 17:00 Formulation of meeting conclusions and recommendations.
Formulation of an Executive Summary of the meeting.
- 17:00 - *Adjourn of the Meeting*

**Report on Activities of IAEA A+M/PMI Data Unit
(Period: July 1996 - May 1998)**

R.K. Janev

Contents:

1. **Introductory Remarks and Highlights**
2. **Co-ordinated Research Projects (CRPs)**
3. **Co-ordination of A+M Data Centre Network Activities**
4. **AMDIS and ALADDIN Development**
5. **Bibliographic A+M Data Bulletin**
6. **IAEA A+M/PMI Data for Fusion (AMID) Series**
7. **Expert Meetings 1996 - 1998**
8. **Other Data Related Activities**
9. **Programme Plan for 1999 - 2000
(and partial projections for 2001 - 2002)**
10. **Organizational Matters**

1. Introductory Remarks and Highlights of Activity

The activity of the Atomic and Molecular (A+M) Data Unit of the IAEA Nuclear Data Section in the reporting period (July 1996 - May 1998) was carried out in accordance with the established IAEA regular programmes (for the programme cycles 1995-1996 and 1997-1998) and within the frame of available resources. The A+M Data Unit activity closely followed the recommendations of the IFRC A+M Subcommittee given at its 8th (1994) and 9th (1996) meetings. The programme implementation was, in general, done within the planned time frame and with the anticipated results. A relatively small fraction of Unit's activity was directed towards exploring the possibilities of hosting an international database on irradiated nuclear graphite properties, the establishment of which may begun in 1998 under the auspices of IAEA. There have been no changes in the Data Unit's manpower during the reporting period (two professional and one general staff members). However, 7 individual consultants have been invited for a total effective period of 8 man-months to assist the Unit in its work.

Among the highlights of Data Unit activity during the reporting period are:

- Completion of the Chemical Erosion Handbook (publication in progress),
- AMDIS on WWW (A+M Data Unit Web Home Page operating since November 1997),
- Initiation of an extrabudgetary project on irradiated nuclear graphite properties.

2. Status of Co-ordinated Research Projects (CRPs)

A. CRPs completed during 1996 - 1998 period

- 1) "Radiative Cooling Rates of Fusion Plasma Impurities"
(June 1994 - June 1997; 9 participants)

1st RCM : November 1994

2nd RCM : October 1996

Output: Recommended radiative power losses for He, Be, C, N, O and Ne impurities for a broad range of plasma parameters.

Note: The power loss calculations are almost completed. Results will be published in the IAEA APID ("green book")-series "Atomic and Plasma-Material Interaction Data for Fusion" during 1998. Main contributors: H. Summers, R.E.H. Clark and R. Marchand (with their groups).

- 2) "Collection and Evaluation of Reference Data for Thermo-Mechanical Properties of Fusion Reactor PFCs"
(July 1994 - July 1997; 7 participants)

1st RCM : November 1994

2nd RCM : March 1996

Output: Compendium on thermo-mechanical properties data for fusion reactor materials.

Note: Preparation of the compendium is in progress. About 20 experts will contribute to the Compendium (most of them being members of ITER JCT and HTs, (see Attachment 1). Deadline for manuscript submission:

mid 1998.

The compendium will be published as a separate issue of APID-Series in 1999. Guest editors for this issue are: Dr. V. Barabash, Dr. I. Mazul, Dr. H. Stamm and Dr. T. Burchell.

3) “Tritium Retention and Release from Fusion Reactor PFCs”

1st RCM : October 1995

2nd RCM : not held

Note: Because of the loss of the position of Dr. R. Langley (the Scientific Secretary for this CRP) in May 1996, the 2nd RCM was not held. For the same reason no Final Report publication for this CRP has been planned. The CRP is administratively terminated.

B. CRPs running or initiated during 1996 - 1998

1) “Atomic and Plasma-Wall Interaction Data for Fusion Reactor Divertor Modeling”
(March 1995 - March 1998; 12 participants)

1st RCM : November 1995

2nd RCM : July 1997

Output: Pending

Note: Following the recommendation of IFRC A+M Subcommittee (1996, 9th Meeting) and of the CRP participants (2nd RCM, 1997), a request for extension of this CRP for additional two years (1999-2000) has recently been submitted to the IAEA Programme Co-ordination Committee, (Subcommittee for Nuclear Applications). Approval of this extension has been anticipated in the Section's programme and budget proposal for 1999-2000, with two planned CRP related meetings: a 3rd RCM in 1999 and Consultancy Meeting in 2000. The final results of this CRP will be published in 2001 as an IAEA Technical Document or as a separate volume of the IAEA Technical Document or as a separate volume of the IAEA APID (green book)-series, or in some other form. The list of CRP participants in the extended period of its work is given in Attachment 2.

2) “Charge Exchange Cross Section Data for Fusion Plasma Studies”
(December 1997 - December 2000, 14 participants)

1st RCM : 24-25 September 1998

2nd RCM : 2000 (planned)

Composition: 12 Research Agreements + 2 Research Contracts (RC)

Countries represented: Austria, France, Germany, Hungary (RC), Japan (3), Netherlands, Norway, Russia (RC), Spain, United Kingdom, USA (2).

Output: Technical Document (as Final CRP Report) to be published in 2001. The list of CRP participants is given in Attachment 3.

3) "Plasma-Material Interaction Data for Mixed Plasma Facing Materials in Fusion Reactors"

(December 1997 - December 2000, 10 participants)

1st RCM : October 19-20, 1998

2nd RCM : 2000 (planned)

Composition: 8 Res. Agreements + 2 Res. Contracts (RC)

Countries: Canada, Germany (2), Japan, Russia (2, one RC), Spain, USA (2),
Uzbekistan (RC).

Output: Technical Document to be published in 2001.

The list of CRP participants is given in Attachment 4.

C. Individual Research Projects (in support to CRPs)

Six individual research projects were financially supported by the Agency to enhance the work of certain CRPs. Three of these projects were from the A+M data area, and the other three had research subjects from the PSI area. Because of lack of funds, six other research contract proposals of relevance to the objectives of some CRPs had to be rejected.

3. **Co-ordination of A+M/PMI Data Centre Network (DCN) Activities**

3.1. Current structure of A+M/PMI DCN

The structure of A+M/PMI Data Centre Network was in recent years undergoing gradual changes: the atomic data centres at JILA and at the Chinese Nuclear Data Centre have formally ceased to exist. The collaboration with the Data Centre for Highly Charged Ions at the Russian Institute VNIIFTRI has also become weaker due to the redirection of institutes activities. On the other hand, A+M or PSI/PMI data groups have been established (formally or informally) in several institutes (IPP, Garching; Troitsk Institute for Technological Innovations (former branch of the Kurchatov Institute), Korean Atomic Energy Research Institute, Taejon; Efremov Institute, St. Petersburg; Weizmann Institute of Science, Rehovot) which started active data work in the A+M/PMI fields and active cooperation with the IAEA and the A+M DCN.

The current composition of A+M/PMI DCN is given in Attachment 5.

3.2. Work Co-ordination

The A+M/PMI DCN convened its 14th meeting on July 21-22, 1997 in Vienna. The Summary Report from this meeting was published as an internal IAEA report (INDC(NDS)-377, January 1998) and distributed to relevant recipients (including the IFRC A+M Subcommittee members). The central topics discussed at this meeting were the status of data compilation, evaluation and generation capabilities of the DCN, priorities in the DCN work, data processing, exchange and dissemination aspects (including use of the modern electronic communication tools), upgrading of ALADDIN, AMDIS mirroring and joint collaborative projects within the DCN.

The data compilation and generation activities of A+M/PMI DCN members are, to a large extent, focussed on the priorities set up by the IFRC A+M Subcommittee and are conducted to support the ongoing IAEA CRPs. The level of work co-ordination within the A+M/PMI DCN can be considered as very good.

4. AMDIS and ALADDIN Development

4.1. Numerical Databases Ready for Addition to AMDIS

1) *Chemical Erosion Database*

This ALADDIN formatted database includes all available (critically assessed) chemical erosion information for carbon materials and impact particles of fusion interest. Erosion yields, as function of surface temperature, particle impact energy and/or particle flux, are given for about 1000 collision systems.

2) *Atomic Spectra Database (ASD)*

The NIST database is presently being prepared for transfer to the A+M Data Unit, and this will ultimately be added as an available database in AMDIS. The ASD database and search engine is 13 MB in size, and NIST has already developed a version which is installable on IBM RS6000 UNIX systems.

3) *Elastic and Momentum Transfer Database*

This database has been developed by the ORNL Atomic Data Centre and includes numerical and analytically fitted cross section (total and differential) information for the elastic scattering and momentum transfer processes in the energy range 10^{-3} - 10^2 eV/amu for all ion(atom) - atom/molecule combinations of hydrogen (in atomic and molecular form) and helium (including all isotopic versions of hydrogen). The analytic fit functions for the cross sections are ALADDIN formatted and are ready for introduction into AMDIS.

The list of numerical databases which are presently included in AMDIS and which can be accessed on-line via Internet and WWW is given in Attachment 6. All of these databases can be downloaded also as a whole document.

4.2. A+M Data Unit WWW Homepage

The A+M Data Unit's Web Homepage has become operative in November 1997. The main function of this Homepage is to provide information on A+M Data Unit activities and a Web site for AMDIS for direct access to (and retrieval of) its data. The design and some of the elements included in the Data Unit's Homepage are illustrated in the Attachment 7. The next phase of Web development will be to move Web serving from NESI to the Data Unit's RS6000/E30 Unix server, and to access its databases directly through the use of query forms. Graphics which enable plotting of evaluated data on the Web page is also being planned. These developments will require the appropriate Perl/CGI programming planning and design, utilizing the existing AMDIS search engine. The above configuration will avoid the use of user telnet sessions to access the database. Full Web usage statistics can also be enabled under this configuration.

4.3. Statistics for the On-line Use of AMDIS/ALADDIN

On-line use of the AMDIS/ALADDIN system is available through a telnet account on the Data Unit's RS6000/E30 computer. Independently, the Data Unit's Web site provides access to direct downloading of ALADDIN formatted files and programs. The Web site also has a page which enables initiation of a telnet session. Since June 1996 there have

been about 2000 external usages of the on-line bibliographic and ALADDIN programmes (excluding searches performed by the Data Unit). Since November 1997 the index page of the Data Unit's Web site has been accessed on average over 100 times a month, and access to the ALADDIN data files via the Web page is significant. Attachment 8 shows graphs of the telnet access usage of the AMDIS/ALADDIN system on a month-by-month basis. Some statistics for Web page usage of the Data Unit Web site are also given.

4.4. Status of AMDIS/ALADDIN Documentation

Documentation for the AMDIS/ALADDIN system is available to users in three ways: a User's Manual sent by regular mail upon request, Latex and Postscript versions of the User's Manual which reside on the Data Unit's anonymous ftp server, and the same files which can be downloaded from the A+M Data Unit's Web site. The A+M Data Unit's Web site also has extensive documentation pages on ALADDIN and examples of ALADDIN formatted files.

4.5. Current A+M Data Unit computer equipment

- 1) A new IBM E30/RS6000 UNIX computer was acquired and installed and it is now used for A+M Data Unit publication projects, WWW development and maintenance, and new database projects development. The AMDIS/ALADDIN system was also transferred to this machine and now provides database services to external users via telnet links to a user account.
- 2) Two older IBM/RS6000 UNIX computers are maintained for use by visiting consultants, other staff members of the NDS, and for additional file storage and backup.
- 3) Following the receipt of funds for an extrabudgetary programme to establish an "International Database on Irradiated Nuclear Graphite Properties", the A+M Data Unit has procured a Compaq Deskpro 6000 Personal Computer, associated hardware, Microsoft Windows NT 4.0 operating system, and associated relational database software. This procurement is required to establish and maintain a prototype nuclear graphite database within the A+M Data Unit. The database was initially developed in the Department of Materials Science and Engineering, Nuclear Materials Group, Bath University, UK, and its establishment within the A+M Data Unit is proceeding with their collaboration.

5. **Bibliographic A+M Data Bulletin and CIAMDA-III**

The following volumes of the "International Bulletin on Atomic and Molecular Data for Fusion" have been published during the reporting period:

Vols. 50 and 51 (jointly)	:	October 1996
Vol. 52	:	August 1997
Vol. 53	:	November 1997

Volume 54 of the Bulletin is now in preparation and should appear within one-two months.

Main input to the Bulletin continues to be received from the ORNL (about 80-90%), NIST (5-10%), NIFS, GAPHYOR and Kurchatov Institute A+M data centres. The number of printed and distributed (free of charge) copies of each Bulletin issue is 800.

All the bibliographic data information is now included in AMDIS and is on-line accessible. The bibliographic part of AMDIS is called AMBDAS and contains 35600 entries.

The work on preparation of the next issue of CIAMDA (Computerized Index of Atomic and Molecular Data for Fusion) has continued. CIAMDA-III, which will cover the A+M data information from AMBDAS for the period 1987-1997, will have a new format and will be produced by a new editing procedure. In developing the new format and editing procedure for CIAMDA-III, the A+M Data Unit received substantial help from Dr. J. Botero (Bogota, Colombia).

The production of CIAMDA-III is expected within next one-two months. CIAMDA-III will contain 6900 entries on about 600 pages.

CIAMDA-III, like the previous volumes of this series, will contain only A+M (spectroscopic and collisional) bibliographic information. The A+M Data Unit plans to produce a special volume of CIAMDA covering all the particle-surface interaction data information contained in AMBDAS. The publication of this CIAMDA issue is planned for 1999, but will depend on the available funds.

6. IAEA Series on "Atomic and Plasma-Material Interaction Data for Fusion" (APID- Series)

6.1. Publication Dynamics/Schedule

The last issue of the APID (or "Green book")-series (vol. 6) was published in 1995. The substantial delay in the publication of vol. 7 (for 1996) and vol. 8 (planned for 1997) was caused by the delay in submission of planned contributions. The current publication plan for the next volumes of this series is as follows:

Vol. 7 "Particle Induced Erosion of Be, C and W in Fusion Plasmas"

(1997) Part A: Chemical Erosion

Status: Manuscript ready for printing. Publication expected in the next one-two months.

Authors: Haasz, Stephens, Vietzke, Eckstein, Davis, Hirooka

Vol. 7 Part B: Physical Sputtering and RES

(1997) Status: Manuscript in preparation. Expected publication by the end of 1997

Authors: Haasz, Stephens, Eckstein, et al.

Vol. 8 Elastic, Momentum Transfer and Viscosity Cross Sections for Hydrogen and Helium Ion(Atom)-Atom/Molecules Collision Systems (including all isotopes)

(1998) Part A: Ion(atom) - atom collision systems

Status: All cross section calculations and analytic fitting completed. Volume editing in progress. Manuscript submission expected in about one month.

Authors: D.R. Schultz, P.S. Krstic (ORNL)

(1998) Part B: Ion(atom)-molecule systems

Status: All cross section calculations performed. Analytic fitting of cross sections is in progress. Manuscript submission expected in 3-4 months.

Authors: D.R. Schultz, P.S. Krstic (ORNL)

Vol. 9 Radiative Power Loss of Fusion Plasma Impurities

(1998, or 1999) Status: Power loss computations for He, Be, B, C, O, Ne, and possibly also for Ar and Kr are in progress (for He and Be completed). Expected completion of the project: second half of 1998.

Main contributors: H.P. Summers, R.E.H. Clark, R. Marchand

Vol. 10 Thermo-mechanical Properties of Plasma Facing Fusion Reactor Materials

(1999) Status: Writing of contributions in progress. Deadline for manuscript submission: mid 1998. Expected (realistic) date of manuscript submission: September/October 1998. Expected project completion: end of 1998. Volume publication (expected): Spring 1999.

Guest editors: V. Barabash, I. Mazul, H. Stamm, T. Burchell

Note: Accumulation of several APID manuscripts for publication in 1998 (covering also 1997) may cause some problems in their printing during 1998 due to limited printing funds. Some flexibility is expected in this respect on the Sectional and Divisional level.

6.2. Change of the Status of APID-Series

The APID series was initiated in 1990 as a regular A+M annual supplement to the IAEA "Nuclear Fusion" journal. For the first three volumes of the series, the technical aspects of editorial and publishing process were covered by the Editorial Office of "Nuclear Fusion". The editorial and production costs for each Nucl. Fusion A+M Supplement were on the level of about \$ 20.000 - 25.000 and were borne by the Nuclear Data Section. Cuts in the Nuclear Data Section budget in the period 1993 - 1995 made impossible for the Section to pay the editorial and type-setting costs of "Nuclear Fusion" Office (which were more than half of the total publication costs) and starting with vol. 4 (1993) all editing was done by the A+M Data Unit. The manuscripts were prepared for printing in a camera-ready format. Thus, the production cost of vol. 4 (1993) - vol. 6 (1995) was reduced considerably, and kept at a level (\$ 8.000 - 10.000) consistent with the Nuclear Data Section budget possibilities. In this new mode of production of the APID series, the role of the "Nuclear Fusion" Editorial Office disappeared completely. Moreover, starting with 1995, "Nuclear Fusion" became a self-supporting journal imposing page charges on the authors (~ \$ 70-80/page). The loss of control by the Nucl. Fusion Editorial Office over the editorial process of APID volumes production, on one side, and the inappropriateness of imposing page charges on the contributors to the APID volumes, on the other, have converged in the conclusion of the IAEA Publication Division that the APID series should be separated from the Nucl. Fusion journal (i.e. not referred to as supplement to this journal). This point of view is further justified by the fact that, as part of the "Nuclear Fusion" journal, the APID volumes should normally be distributed to the "Nuclear Fusion" subscribers (about 270) at no additional charges, which would increase the printing costs for APID volumes (with no compensation to the Nuclear Data Section). The limited annual printing funds available in the Nuclear Data Section for printing of APID volumes and the fixed (and relatively large) number of

"Nuclear Fusion" subscribers, make impossible for the Nuclear Data Section to commit itself financially to such large fixed printing costs. (It should be noted that about 150 copies of APID volumes, as well as of any other IAEA publication, are distributed to the IAEA Member States free of charge on a mandatory basis. This also increases the fixed costs for APID volumes).

Therefore, the separation of the APID series from the "Nuclear Fusion" journal looks, under the present circumstances, as a justified step.

The number of printed copies of APID volumes was so far 600 with the following (approximate) distribution:

- 150 copies to IAEA Member States (obligatory),
- 250 copies to A+M/PMI community (free of charge),
- 200 copies for sale.

(The sale of APID volumes (at a price \approx ATS 300) is usually on the level of 120-150 copies. The income from the sale, however, is not returned to the Nuclear Data Section). The non-obligatory part of the above distribution provides a certain flexibility in handling the printing costs of APID volumes which, in view of the frequent fluctuations of Nuclear Data Section's budget, can be considered as a convenient feature.

6.3. Editorial Board of the APID Series

The Editorial Board of the APID-Series oversees the publication policy, scope and quality of the contributions, and its members frequently serve as referees for the submitted articles. According to the Terms of Reference, members of the Board are appointed by the IFRC A+M Subcommittee for a period of five years, with a possibility of reappointment for additional five years. The Subcommittee itself should be represented in the Board by up to 4 members. The Head of the A+M Data Unit serves a scientific Editor of the series.

The present composition of the Editorial Board (up to vol. 6, 1995) is:

V.A. Abramov	(RF)	A. Miyahara	(JPN)
R. Behrish	(GER)	R.A. Phaneuf	(USA)
H.-W. Drawin	(FR)	D.E. Post	(USA)
W.B. Gauster	(USA)	H.P. Summers	(UK)
H.B. Gilbody	(UK)	H. Tawara	(JPN)
Yu.V. Martynenko	(RF)	W.L. Wiese	(USA)
A. Kingston	(UK)		

At the last Subcommittee meeting it was decided to replace Dr. Drawin (retired) by Dr. Mattioli (FR). At the present meeting the Subcommittee may wish to nominate replacements for other members of the Board (all of which have served more than five years), such as Dr. V. Abramov (deceased), Prof. A. Miyahara (retired), R. Phaneuf (not anymore active in the A+M data field), D. Post (not anymore in fusion research) and possibly some other members. The question of nomination of a Chairman of the Editorial Board can also be considered. The modified Terms of Reference of the Editorial Board, reflecting the new status of the APID series, are given in Attachment 9.

7. Expert Meetings and Consultants (June 1996 - 1998)

June - December 1996

- 1) CM on "Critical Assessment of the Electron-Impact Cross Section Database for Be and B Plasma Impurity Ions"
(September 1996; 3 participants),
- 2) 2nd RCM on "Radiative Cooling Rates of Fusion Plasma Impurities"
(October 1996; 7 participants),
- 3) CM on "Preparation of Handbook on Erosion Rates of Fusion Reactor Plasma Facing Materials"
(December 1996, 4 participants).

1997

- 1) Advisory Group Meeting on "Technical Aspects of Atomic and Molecular Data Processing and Exchange (14th Meeting of the Atomic and Molecular Data Centres and ALADDIN Network)"
(July 1997; 14 participants),
- 2) CM on "Critical Assessment of Charge-Exchange Cross Section Data for Fusion Studies and Definition of the Scope of a CRP on the Same Subject to be Initiated During 1997"
(July 1997; 5 participants, 2 observers),
- 3) 2nd RCM on "Atomic and Plasma-Wall Interaction Data for Fusion Reactor Divertor Modeling"
(July 1997; 12 participants, 5 observers),
- 4) CM on "Status of Plasma Induced Erosion Data for Fusion Reactor Materials"
(August 1997; 4 participants).

1998

- 1) CM on "Establishment of an International Database on Irradiated Nuclear Graphite Properties"
(February 1998; 8 participants),
- 2) TCM: 10th IFRC A+M Subcommittee Meeting
(May 1998; 7 participants),
- 3) 1st RCM on "Charge Exchange Cross Section Data for Fusion Plasma Studies"
(24-25 September 1998; 14 participants; expected),
- 4) 1st RCM on "Plasma-Material Interaction Data for Mixed Fusion Reactor Materials" (19-20 October, 1998; 10 participants; expected).

**Individual Consultants to the A+M Data Unit
in the period June 1996 - May 1998**

Consultant	Period	Task
1) Dr. J. Botero (Colombia)	June 24 - July 19, 1996	To assist with AMDIS, CIAMDA-III
2) Dr. P.S. Krstic (USA)	November 11-24, 1996	To assist with WWW Home Page
3) Dr. E.A. Solov'ev (Macedonia)	December 2-15, 1996	Data generation and assessment
4) Dr. I.V. Komarov (Russia)	December 11-24, 1996	Erosion Handbook (data fitting)
5) Dr. Wang Dahai (Austria)	June 1996 - March 1997	Erosion Handbook (data collection digitization and fitting)
6) Dr. Yu. Ralchenko (Israel)	November 24-28, 1997	Erosion Handbook (data fitting)
7) Dr. R. Celiberto (Italy)	August 28 - Sept. 16, 1997	Data generation and assessment (with no support from the IAEA)

8. Other Data Related Activities

8.1. Participation in International Meetings

- 1) International Symposium on Atomic and Molecular Processes in Fusion Plasma (NIFS, Nagoya, September 17-19, 1996)
 - Membership in Int. Programme Committee
 - Invited Talk
- 2) 6th Workshop on Fast Ion-Atom Collisions (Debrecen, Sept. 4-6, 1996)
 - Invited Talk
- 3) 20th Int. Conf. Phys. Electronic and Atomic Collisions (ICPEAC) (Vienna, July 23-29, 1997)
 - Progress report
 - Session chair
 - Posters
- 4) 6th Int. Workshop on Plasma Edge Theory in Fusion Devices (Oxford, Sept. 15-17, 1997)
 - Invited talk
- 5) Workshop on Atomic Processes in Low Temperature Edge Plasmas (Oxford, Sept. 18, 1997)
 - Membership in Int. Programme Committee
 - Session chair
- 6) 1st Int. Conf. Atom. Mol. Data and their Applications (ICAMDATA)

(NIST, Gaithersburg, Sept. 29 - Oct. 2, 1997)

- Membership in Int. Programme Committee
- Organization of a panel discussion on establishment of international A+M databases
- Presentation of AMDIS (Dr. J. Stephens)
- Session chair

Especially important was the contribution of A+M Data Unit to the programme determination of the meetings 1), 5) and 6) above. The programme of the 1st ICAMDATA Conference is given in Attachment 10. The 2nd ICAMDATA will be organized in Spring 2000 in UK (Oxford area), with Dr. K. Berrington of Queen's University of Belfast acting as Local Chairman.

8.2. Visits to A+M Data Centres and Research Laboratories

For enhancing the co-ordination within the A+M Data Centre Network activities and the conducted CRPs, the Data Unit professional staff in the reporting period paid the following visits to some of the A+M DCN data centres and some research laboratories:

R.K. Janev

- 1) Visit to NIFS (Nagoya), Sept. 21-22, 1996, to discuss the NIFS A+M Data Centre programmes, including those related to two ongoing CRPs;
- 2) Visits (October 21-26, 1996) to A+M/PMI data centres of the Kurchatov (Moscow) and Efremov (St. Petersburg) institutes and to corresponding research laboratories of the Lebedev (Moscow) and Ioffe (St. Petersburg) institutes to discuss the status of their work and contributions related to certain IAEA A+M data projects;
- 3) Visit to NIST (Gaithersburg, April 21-23, 1997) to discuss the possibility for transfer of their Atomic Spectroscopy Database to AMDIS, the NIST data related research programmes, and to participate in the Programme Committee Meeting of ICAMDATA;
- 4) Visit to JET (September 19, 1997) to discuss the molecular database of ADAS and the IAEA-JET collaboration in ADAS/AMDIS database matters.

J. Stephens

- 5) Visit to NIST (Gaithersburg, Sept. 29 - Oct. 2, 1997) to discuss the technical aspects of the transfer of NIST Atomic Spectroscopy Database to AMDIS, and to participate in the work of 1st ICAMDATA;
- 6) Visit to Bath University (Dept. of Material Sciences and Engineering, Bath, UK, January 25-28, 1998) to discuss the technical aspects related to the establishment of international irradiated nuclear graphites database (to be hosted by the IAEA);
- 7) Visit to Freiburg University (Dept. of Physics, Freiburg, Germany, February 25-27, 1998) to assist an experimental group in analysis of the spectra of H₃⁺.

8.3. Major A+M Data Related Publications (published outside IAEA)

- 1) "Atomic and molecular processes in fusion plasmas" (R.K. Janev)
Proc. Int. Symp. Atomic and Molec. Process in Fusion Plasmas; Ed. H. Tawara

- NIFS-DATA-Series 38, 3 (1996).
- 2) "Atomic and molecular processes in SOL/divertor plasmas (R.K. Janev)
Contrib. Plasma Physics 38, 307 (1998)
(Proc. 6th PET Workshop, Oxford, UK, Sept. 15-16, 1997).
 - 3) "International co-ordination of atomic and molecular data efforts" (R.K. Janev et al)
Proc. Ist ICAMDATA, Eds. P.J. Mohr and W.L. Wiese (AIP, ... 1998) p. xx
 - 4) "Excitation processes in collisions of atoms with multiply charge ions" (R.K. Janev)
in: "Atomic Physics with Heavy Ions", Ed. H. Beyer and V. Shevelko (Springer,
Berlin, 1998) p. xx

9. Programme Plan for 1999-2000 (and partial projections for 2001-2002)

The A+M Data Unit programme for 1999-2000 includes 19 "tasks" which are distributed over 4 Nuclear Data Section's projects and belong to the Agency Sub-programme G.1 "Nuclear and Atomic Data for Applications" (part of the IAEA programme G: "Physical and Chemical Sciences"). The Nucl. Data Section projects are as follows:

- G.1.01. Data Centre Activities
- G.1.02. Data Network Co-ordination
- G.1.03. Nuclear Data Assessment and Improvement
- G.1.04. Establishment of International A+M/PMI Databases
- G.1.05. Data User Support and Promotion

The A+M Data Unit programmatic tasks for the period 1999-2000 are shown in Attachment 11. This programme has been discussed and approved by the IFRC A+M Subcommittee at its last meeting and is included in the Agency Programme and Budget proposal for 1999-2000 (to be approved, after thorough discussions by the Agency Board of Governors and the Member States, by the Agency General Conference in September 1998). It should be noted that for the task G.1.04/T8 (Initiation of a CRP on A+M data for fusion plasma diagnostics) no financial expenses (except for the work of the A+M Data Unit staff) have been planned for the 1999-2000 period.

The A+M tasks in the projects G.1.01, G.1.02 and G.1.05 reflect the basic continuing activities of the A+M Data Unit and their structure is more or less invariant. The dynamical part of the A+M Data Unit activities is contained in the project G.1.04 which, reflecting the evolution of the Unit's database establishment programme, is subject to changes in each Agency programme and budget cycle. Since the preparation of the programme for the next cycle will begin in the second half of 1999, the IFRC A+M Subcommittee is invited to formulate its A+M/PMI data programme recommendations to the Agency for the 2001-2002 period already at the present meeting. A proposed partial programme for the G.1.04 project for 2001-2002 period is given in Attachment 12. It is suggested that all A+M/PMI data tasks in the projects G.1.01, G.1.02 and G.1.05 remain the same (with the necessary modifications for the year when "related action" is to be taken (when applicable)).

10. Organizational Matters

The current contract of the Head of A+M Data Unit expires on March 30, 1999. A request for extension of the contract for one additional year has been made by the Nuclear

Data Section and is now being considered by the corresponding IAEA committee. In any case, there is a high probability that the present Head of the A+M Data Unit will be not preparing the Unit's activity report for the next Subcommittee meeting (except if his contract is continued for additional 3-4 months beyond March 2000). The current contract of Dr. J. Stephens expires on May 20, 1999, and a request for its two year extension was made recently by the Nuclear Data Section.

The IFRC A+M Subcommittee may wish to take into account these facts when considers the Data Unit programmes for the period 2001-2002.