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INTERNATIONAL NUCLEAR DATA COMMITTEE

IAEA Technical Committee Meeting:

9TH MEETING OF THE IFRC SUBCOMMITTEE ON ATOMIC AND MOLECULAR DATA FOR FUSION

1 - 2 July 1996, Vienna, Austria

SUMMARY REPORT

Prepared by R.K. Janev

April 1997

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

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Abstract

A brief account of the proceedings and a summary of the conclusions and recommendations of the 9th Meeting of the IFRC Subcommittee on Atomic and Molecular Data for Fusion, held on July 1-2, 1996, at the IAEA Headquarters in Vienna, Austria, are provided. The Report on the activities of the IAEA Atomic and Molecular Data Unit for the period September 1994 - June 1996 is also appended to the present Summary Report.

Used Abbreviations

IFRC	-	International Fusion Research Council
A+M ...	-	Atomic and Molecular ...
AMDIS	-	Atomic and Molecular Data Information System
AMDU	-	Atomic and Molecular Data Unit
CRP	-	Co-ordinated Research Programme
RCM	-	Research Co-ordination Meeting
AGM	-	Advisory Group Meeting
TCM	-	Technical Committee Meeting
SM	-	Specialist Meeting
CM	-	Consultants' Meeting
SSA	-	Special Service Agreement
PMI ...	-	Plasma-Material Interaction ...
DCN	-	Data Center Network
NDS	-	Nuclear Data Section
INDC	-	International Nuclear Data Committee

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April 1997

Table of Contents

1. Introduction

The 9th Meeting of the IFRC Subcommittee on Atomic and Molecular Data for Fusion (IFRC A+M Subcommittee) was held on July 1-2, 1996, at the IAEA Headquarters in Vienna, Austria. All Subcommittee members attended the Meeting except for Dr. P.T. Greenland (UKAEA, Harwell), Dr. E. Menapace (ENEA) and Dr. Y. Kikuchi (JAERI), who was represented by Dr. T. Shirai (JAERI). The staff of the IAEA Atomic and Molecular Data Unit (AMDU) also attended the Meeting. Dr. J. Botero, who was on a consultancy visit to the IAEA AMDU during June-July 1996, was also invited to attend some of the Meeting sections and provide information on certain technical aspects of AMDIS. The first session of the meeting was attended also by Dr. D. Muir, Head of the Nuclear Data Section and Dr. P. Obložinský, Deputy Section Head.

2. Meeting Proceedings

Opening Session

Dr. D. Muir opened the meeting and thanked the subcommittee for coming to the IAEA, and emphasized his support for the effort of the A+M Data Unit.

Dr. R. McKnight, the chairman, began the meeting discussing management and policy issues of the IFRC Subcommittee and its role of support for the IAEA A+M Data Unit. In addition to continuing the A+M Data Unit's mission of collecting and evaluating data for fusion, he opened a discussion on its potential role for doing similar work for non-fusion data (e.g. plasma spray technologies). He emphasized the increased role of on-line data services and outreach via the Internet, particularly the World-Wide-Web (WWW).

Dr. D. Muir submitted a suggestion of Mr. R. Iyer of combining the nuclear and atomic and molecular databases on the NDS Alpha VAX-server. This suggestion was opposed by both the A+M Data Unit and the IFRC Subcommittee on technical and logistical grounds. Some of the discussion occurred in the Programme implementation assessment and at the close of the meeting, discussed below.

Dr. P. Obložinský was also present, and outlined the RI budget as supporting 70% staff costs and 30% programme costs. A 9% cut in the 1995 budget resulted in the elimination of two P4 positions and 1 G6 position. This was part of the justification for the transferral of Dr. R. Langley's P4 position back to the Nuclear Data Services.

Leading into Session 1, R. McKnight inquired about completed tasks and new ones planned.

Session 1: Report of the IAEA AMDU on A+M/PMI Data Activities and Related Discussions

R. Janev gave a report of topics 1-10 on the activities of the A+M Data Unit for September 1994 - July 1996 (see Appendix 3).

J. Botero briefly discussed the new online AMDIS service, available since July 1995. Even though AMDIS was not widely advertised in the period July 1995 - June 96, strong optimism was expressed about its accepted utility. This was based on positive usage statistics collected in that time period.

The loss and transferral of R. Langley's P4 position was discussed and its implications for the Unit were discussed. The Subcommittee was very disappointed in this outcome, particularly with reference to the Unit's role in collecting and evaluating material property data for plasma facing components in Tokamak reactors, and plasma science in general.

The administrative position of the IAEA on its support for fusion (or lack thereof) was discussed. In particular, if fusion is only for "rich" nations, then it is not desirable for IAEA to support it. R. Janev made the point if the data is useful in other context, e.g. non-fusion applications and plasma-processing, then this is of interest to developing countries. D. Post mentioned there is some danger in carrying that too far, since the IAEA may again question 'relevance' if the work deviates significantly from the non-nuclear energy field. It was generally agreed that spin-offs for and demands by developing countries are significant, and that the Agency should hear and be aware of this broader scope. R. McKnight emphasized bringing in plasma physics. Plasma physics is the working medium for fusion, and e.g. divertor devices, etc., so the experience and collected data is here.

The loss of Langley's position was further discussed. It was suggested that in lieu of this, the Agency should be willing to fund outside help in the form of experts and consultants, e.g. for 2 weeks - several months duration. Governments, or organizations, could also fund visits to the A+M Data Unit, particularly for the material science data, for 3-4 months durations. The material properties data aspect was emphasized by J. Roth. It was suggested that even students, for work and international experience, could be sent to perform technical work such as data fitting, data input, and other clerical tasks.

D. Post made the point that the VMS operating system was good in the past, and some

are still maintained, e.g., the BNL Nuclear Data Center. But most have already or are now converting to UNIX. For example, ORNL-CFADC, a leading center in the A+M data field has. This technical point was made in regard to the suggestion of R. Iyer.

Session 2: Analysis of A+M Data Center Network Activities

R. McKnight reviewed support from DOE for fusion science in the US. For 1995-96 they requested $350M and received $250M (this could be for 1996-97). DOE supporters the BNL Nuclear Data Center, and the ORNL-CFADC Center, which had some cuts, but is otherwise stable. The NIST Atomic Data Center also gets support from his office.

R. McKnight emphasized maintaining visibility of the data centers at major physics meetings, e.g. the APS/Plasma Physics Meeting and the APS/DAMOP meeting. The ICPEAC next summer and the related satellite meeting is a good forum as well.

H. Tawara reported that they have 4 staff, and their funding is stable. Korea is interested in getting its own center going.

V. Abramov reported that they have 4 staff and that funding is stable.

Other IFRC members reported stable funding conditions.

D. Post emphasized that gaps in fusion data were more problematic than formatting of the data, particularly impurity effects in plasma transport calculations. Discussion was opened on the question of converting basic data to reaction rate coefficients, and whether the data producers or users should do this. It was concluded that the data users should. R. Janev raised the question if high-quality atomic codes, some of which are now available, should be employed directly by the various data centers. No consensus was reached.

Session 3: Review of A+M/PMI Data Needs

D. Post delivered an overhead presentation and discussion of ITER power balance in divertors and edge plasmas, highlighting the role of atomic and molecular fusion needed for modeling. He mentioned the need for data on the recycled species H, D, T, and He, and data for vibrationally excited molecules. He indicated the need for tables of basic impurity data for modeling, in regards to plasma facing components (Be, C, W, Mo), impurity gases (Ne, Ar, Kr, N) and conditioning materials (Li, B, Si).

V. Abramov mentioned that Kr, W, and Mo data are scarce, and a gap needs to be filled for $e + W^{q+}$ processes in the energy range 2-20 keV in the core plasma. In the edge region it was emphasized by R. Janev and others that charge exchange cross sections are very

uncertain in the low collision energy regime (1-2keV down to thermal energies).

J. Roth gave a discussion of plasma-wall data needs. For H, D, T retention, for pure materials, the data is in relatively good shape. The plasma-wall interaction data is very uncertain at low energy, and new measurements are needed (< 10eV). In reality there is W doping in the divertor material, and C in the divertor walls. Modeling has to account for this now, in contrast to considering pure materials. Erosion data is needed, e.g. for Be sputtering. Be-W interaction potentials are needed for the molecular-dynamics calculations. Roth suggested benchmark studies on modifying the material surface (with dopants Be, C, for example) and then study the plasma- wall interaction. These impurities affect H retention and H reflection coefficients. Quality experiments are needed to validate codes for mixed materials, at lower energy. R. Janev made the point that its hard to define the data, due to changing conditions of materials. The conclusion was that all of these considerations are basic to divertor physics.

Session 4: Near- and Long-Term Programme Plans for A+M/PMI Activity

R. Janev summarized the content of the Agency document "Subprogramme G.1: Nuclear and Atomic Data for Applications 1997-1998" (items 1, 5, 10 on Project G.1.01, items 3, 6, 7, 9, 10 on Project G.1.02, and particularly items 1-7 on Project G.1.04).

For Project G.1.04, the principle modification was to replace item 5 with a CRP on mixed-materials. J. Roth suggested having an Advisory Group Meeting to discuss the scope of this CRP, in conjunction with the CS of task G.1.04/1 (assessment of plasma-induced erosion data for fusion reactor materials).

On item 3 of G.1.04, both H and H_2 are to be included in the scope of this planned CRP.

Task 8 was added to G.1.04 for a AGM on Tritium retention in 1997 (or later), subject to availability of funds.

Task 9 was added to G.1.04, the AGM meeting discussed above for erosion data for mixed fusion reactor plasma-facing materials, if additional funds become available.

Session 5: Operational Aspects of A+M/PMI Data Activity

Following the first session, R. McKnight emphasized the need for short-term consultants here for the material's data work, particularly due to the loss of Langley's P4 position. R. McKnight emphasized the uniqueness of the A+M Data Unit and its accessibility to member states. For PMI work, we must have consultants. R. Janev also suggested to get cost-free

experts. R. McKnight questioned whether DOE could fund people as experts. J. Roth mentioned that such experts could be funded by the EC Human Capital Mobility Fund.

D. Muir was present and suggested emphasizing the role of the Data Center in (1) non-fusion applications (applications for the industrial uses of plasmas, hazardous waste reduction, etc.) (2) on-line data services (3) the suggestion to combine computer systems (4) emphasizing what has been completed, and (5) statistics on usage, more than presently done.

Session 6: Business Matters

The Subcommittee members unanimously approved R. McKnight as chairman for the next two years. R. Janev cited his important position and support for the US fusion data center and NIST.

The question was raised whether China, India, and Korea should have representation on the IFRC Subcommittee. D. Post highly recommended this. A replacement for British representation needs to be found, since P. Greenland is no longer a member.

3. Summary of Meeting Conclusions and Recommendations

The Subcommittee strongly complimented the work of the A+M Data Unit, and would convey this to the IAEA in its reports, but offered some suggestions for improvements. These were improving access on the WWW via a Web homepage, and like some other data centers, incorporating pointers to other data centers or even plasma physics home pages. The existence of the A+M Data Unit and more importantly its available data services (AMDIS) needs to be visible at important physics conferences.

In summary, the IFRC Subcommittee has five basic points to make in its final report to the IAEA:

(1) The loss of personnel (one P-4) is a significant loss of capability for the A+M Data Unit, and this will have to be made up with experts and consultants.

(2) The proposal to merge computers with the nuclear database of the NDS is unacceptable.

(3) Emphasize the application of A+M data to other areas, broadly based needs and applications.

(4) Push hard to get more on-line capability, with ties to other sites. An upgrade in the Unit's server is needed.

(5) In the opening section of their report, a strong statement about the uniqueness of the

IAEA A+M data work, in particular its openness and availability to all member states, sis to be made.

In addition, the following recommendations were made regarding the A+M Data Unit programme for 1997-1998 (and beyond):

(a) Replacement of the previously planned CRP on molecular data for edge plasma modeling and diagnostics by a new CRP on the plasma-material interaction data for mixed materials. This CRP should be initiated in 1997 through holding an experts meeting to define the scope and participants of the CRP, possibly jointly with the planned CS on erosion in 1997 (or independently, if funds allow).

(b) To broaden the scope of the planned CRP on charge exchange data for fusion plasma studies and to hold a Consultancy Meeting in 1997 (if funds become available) to define the scope and participants of the CRP.

(c) To reintroduce the 2nd RCM on Tritium retention in fusion reactor materials in 1997 or 1998 if financial situation is favourable. If that is impossible, to plan an AGM for 1999 to review the subject.

4. Report of the IFRC Subcommittee on Atomic and Molecular Data for Fusion

The IFRC Subcommittee on Atomic and Molecular Data for Fusion met at the IAEA Headquarters on July 1-2, 1996 with 8 members present. New members attending were Dr. J. Roth of Max-Planck-Institute, Garching and Dr. M. Mattioli of Cadarache. Dr. Shirai of Japan substituted for Dr. Y. Kikuchi. Subcommittee members were informed that Dr. Greenland of England had left fusion and the Subcommittee. Absent was Dr. Menapace of ENEA. A list of present Subcommittee members is attached. The Subcommittee asked that the Chairman discuss with IFRC members (on his own initiative) replacements for missing members as well as additions to increase the breadth of representation.

The Subcommittee was welcomed by Dr. D.W. Muir of Los Alamos National Laboratory, who is the new head of the Nuclear Data Section. He indicated that the Division Director, Mr. Iyer, would like to have the Subcommittee input on several management and policy issues. These include: 1) uses of AMDU data outside the fusion community; 2) the role of on-line capability in serving the user community; 3) a proposed combining of AMDU Unix based systems with the VMS based systems of the Nuclear Data Unit; and 4) some indication

of work completed by the AMDU unit. These issues are addressed later in findings and recommendations.

Dr. Janev provided a detailed report on Atomic and Molecular Data Unit (AMDU) activities. With regard to personnel, a critical loss of personnel occurred with the end of Dr. Langley's position in May 1996. Dr. Botero has been replaced by Dr. Stephens from the US. The Subcommittee noted with some concern the long delay (10 months) in replacing Dr. Botero. During the 1994-1996 period, the AMDU maintained substantial activities with the completion of three Coordinated Research Programmes (CRPs) with suitable publication and dissemination of results. An additional 4 CRP's are currently active or being initiated. In addition to summarizing CRP activities, database efforts continue with upgrading of existing data. Expert meetings have been held or planned in the near future to address AMDU activities recommended by the Subcommittee.

The Subcommittee commends the AMDU for the continued high level of productivity. Completion of several data tasks is noted by the publication, or planned publication of several databases.

Findings and Recommendations

1) The IAEA data activities continue to maintain their unique nature by coordinating world wide data center efforts and assuring uninhibited access to data by member states. While reported atomic and molecular data continues at a constant level, it is extremely unlikely that any single country would be able to assume the role of the IAEA data effort. The AMDU continues to bring together the collective work of the 14 active data centers through the Data Center Network.

2) The Subcommittee was asked to address the issue of consolidating the UNIX based activities of the AMDU with the VMS DEC system used by the nuclear data unit. The committee strongly recommends that this consolidation not be carried out and that the AMDU unit continue to use the UNIX based systems. This recommendation is based on the following information and rationale. One of the major tasks of the A+M unit is consolidation and coordination of the activities of the database centers in the member states. The computer systems used at these centers are UNIX - based.

If VMS were the primary operating system used by the AMDU, transfer of data and programs

between the AMDU and the other data centers would require extensive conversion. This would require a substantial increase in computational support at a time when section resources are decreasing. It would be difficult, if not impossible, to maintain mirror sites for the data as is now done. The practical consequence of the AMDU adoption of VMS would be that many of the atomic and molecular data centers would simply ignore the AMDU computer activities rather than deal with a different operating system. In addition, VMS is a proprietary system and is not available for different vendors' work stations. UNIX, on the other hand, is supported and maintained by many vendors.

3. In 1996 the AMDU lost a P4 position which was transferred from the Nuclear Data Group 2 years ago on the special request to strengthen the knowledge in plasma-materials interaction within the unit. The loss of this position occurs at a time where advances in fusion experiments are limited by plasma-retention in future fusion devices. Simultaneously, advances in divertor plasma operation create new boundary conditions for all plasma-material interaction processes and a strong need for new coordinated research in this field. In this field the AMDU has played a unique role in coordinating research programs and collecting, evaluating and distributing new data. This very very important function of the AMDU will be severely damaged by the loss of the position. Even recognizing the critical situation of resources for data work at the IAEA, the IFRC Subcommittee nevertheless recommends the reassignment of this postion back to the AMDU at the earliest feasible occasion. In the mean time, the lost knowledge in plasma material interaction should not lead to a reduction in activities in this filed. Therefore, iring qualified consultants for short time period (say 3 months) is strongly recommended. The Subcommittee also urged that the parties with fusion programs support assignment of experts to the AMDU at no cost to the Agency.

4. The continuing activities on compilation/evaluation of atomic, molecular and plasma wall interaction data over a wide range of energy and particle species (electrons, protons, helim, impurity ions) strongly supports the modelling and diagnostics of fusion plasma and their behaviour. The increasing importance of plasma processes in industrial applications such as materials processing and hazardous waste disposal have developed requirements for data which have a strong overlap with those compiled for fusion research. The Subcommittee urges the Agency to facilitate and actively promote access

to the AMDU data activities on the part of non-fusion users. This outreach to a much wider base of users will aid in the development of laboratory and industrial applications of plasma science.

5. The Subcommittee recommends that the AMDU vigorously increase its visibility by advertising through appropriate means (meetings, site visits, etc.) and that there be increased attention directed toward activities on the WorldWide Web. This increased activity should include links to the IAEA AMDU via the home pages of other data centers of the data center network. It is also important to provide links to the various home pages associated with fusion and other plasma activity home pages including those associated with national laboratories.
6. Recognizing that the additional outreach activities outline in (5), the Subcommittee urges that the Agency begin immediate planning for providing additional computer capabilities to address additional needs.
7. Concern is expressed about the uncertain future of Agency funds for future publications of the International Bulletin of A+M Data for fusion.
8. The Subcommittee recommends the AMDU prepare a summary document detailing completed work carried during the last 10 years, summarizing specific databases and indicating work in progress. This summary should be presented to section and division heads and to Subcommittee members.
9. The Subcommittee notes the approved meetings for 1997. A recommendation is made that the RCM for charge exchange data be broadened to emphasis charge exchange processes in plasmas. In addition to the listed efforts the Subcommittee recommends that a new CM/TCM activity be undertaken on "Atomic Data for Fusion Research". This activity would be as a satellite to the 20th International Conference on Physics of Election and Atomic Collisions".
10. The Subcommittee recommends initiation of a new CRP in 1998 to address plasma material interactions for mixed materials as replacement of the proviously planned CRP on data for edge modeling and diagnostics.

    The Subcommittee also asked that the present chairman continue in that capacity through the next Subcommittee meeting in 1998.

Ronald H. McKnight, Chairman
IFRC Subcommittee on Atomic and Molecular Data for Fusion

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Appendix 1

IAEA Technical Committee Meeting:
9th Meeting of the IFRC Subcommittee on
Atomic and Molecular Data for Fusion

1-2 July 1996, IAEA Headquarter, Vienna, Austria

LIST OF PARTICIPANTS

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Appendix 2

IAEA Technical Committee Meeting:
9th Meeting of the IFRC Subcommittee on
Atomic and Molecular Data for Fusion

1-2 July 1996, IAEA Headquarter, Vienna, Austria

MEETING AGENDA

Monday, 1 July — ***Meeting room: C0737***

09:30 - 10:00	Opening Adoption of Agenda
Session 1:	Review of IAEA A+M/PMI Data Activities
10:00 - 10:30	Report of IAEA A+M/PMI Data Unit activities since the last Subcommittee Meeting
10:30 - 11:00	Discussion related to the Report (status of A+M Data Unit's main programmes)
11:00 - 11:30	***Coffee break***
11:30 - 12:30	Programme implementation assessment
12:30 - 14:00	***Lunch***
Session 2:	Analysis of the A+M Data Centre Network Activities
14:00 - 15:30	Programmes, performance, manpower and financial situation in the national A+M/PMI data centres
15:30 - 16:00	***Coffee break***
Session 3:	Review of Fusion A+M/PMI Data Needs
16:00 - 18:00	Analysis of most recent developments in A+M/PMI data needs in national and international fusion programmes

Tuesday, 2 July

Session 4:	Near- and Long-Term Priorities in the A+M/PMI Data Activities
09:00 - 10:30	Programme priorities for the IAEA and A+M/PMI Data Centre Network - *Prioritized Agency programmes for 1997-1998 and beyond* - *Priorities in Data Centre Network activities*
10:30 - 11:00	***Coffee break***
Session 5:	Operational Aspects of IAEA A+M/PMI Data Activity
11:00 - 12:00	Programme optimization of A+M Data Unit under reduced manpower and budget (for the period beyond 1996)
12:00 - 14:00	***Lunch***
Session 6:	Business Matters
14:00 - 15:00	Subcommittee membership and election of new Subcommittee Chairman
15:00 - 15:30	***Coffee break***
Session 7:	Meeting Conclusions
15:30 - 17:00	Formulation of Meeting conclusions and recommendations
17:00 -	***Adjourn of the Meeting***

Appendix 3

Report on Activities of IAEA A+M Data Unit (Period: September 1994 - July 1996)

R.K. Janev

Content:

1. Inroductory Remarks

- **General:**
  - Programme execution during 1994-96, generally, within the planned schedule.
  - On-line access to AMDIS became operational. Number of accesses in steady increase.
  - Co-ordination within the A+M Data Centre Network effective. Interaction with A+M and Fusion Communities kept strong.
  - Database establishing programmes continued at normal rate.

- **Organizational Changes:**
  - Dr. Botero left the Agency in July 1995.
  - Dr. Botero's position (replacement) filled in on May 20, 1996 (by Dr. Jeffrey Stephens, USA).
  - Dr. Langley's contract expired on May 18, 1996. Position (P-4) transferred to Nuclear Data part of the Section.

2. Status of Co-ordinated Research Programmes (CRPs) and Related Individual Projects

A. CRPs completed during 1994-1996 period

1) "Atomic and Molecular Data for Fusion Edge Plasma Studies" (end 1994)

Results published in:

- Nucl. Fusion A+M Suppl. vol. 2 (1992), vol. 3 (1993).
- Book: "Atomic and Molecular Processes in Fusion Edge Plasmas" (Plenum, N.Y. 1996), pp. 500.

2) "Atomic Data for Medium- and High-Z Plasma Impurities" (end 1994)

Results published in:

- Physica Scripta Topical Issue T37, 1991.
- Physica Scripta Topical Issue T62, 1996.
- Nucl. Fusion A+M Suppl. vol. 6 (1996).

3) "Plasma-Interaction Induced Erosion of Fusion Reactor Materials" (end 1995)

Results published in:

- Handbook on Erosion Data (in preparation)
  - To be published as vol. 7 of Nucl. Fusion A+M Suppl. in 1996/97.
  - Guest Editors/Work Co-ordinators:

    Ekstein, Haasz, Hirooka, Vietzke

B. CRPs Running or Initiated

1) **"Radiative Cooling Rates of Fusion Plasma Impurities"**

(June 1994 - June 1997; 9 participants)

1st RCM : November 1994

2nd RCM : October 1996 (in preparation)

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 (in preparation)

Output : Planned Data Compendium
Completion : 1997

3) **"Tritium Retention and Release from Fusion Reactor PFCs"**

(January 1995 - End 1997; 5 participants)

1st RCM : October 1995

4) **"Atomic and Plasma-Wall Interaction Data for Fusion Reactor Divertor Modeling"**

(January 1995 - End 1997; 12 participants)

1st RCM : November 1995

C. Individual Research Projects (in Support to the CRPs)

CRP#	Project*
A.3.	2
B.1.	2
B.2.	1
B.3.	2
B.4.	3
He-database	2
Be, B-database	2
	14

* Normally one-year projects

3. A+M Data Centre Network Co-ordination

- 13th A+M DCN held in July 1995
- Network Composition : ~ 14 Data Centres
  - Composition virtually unchanged
- Focus of Activities:
  - A+M/PMI processes in divertor plasmas
  - A+M data for radiating divertor

    Impurities : Ne, Ar, N/N_2
  - Quantal surface processes

    (molecular dynamics codes, etc.)
- Degree of Co-ordination : High
- Financial/Manpower situation in DCN: relatively stable

4. Database Establishment Programmes

1) He-database Upgrading

- $e+He^*$ $(1s\ n\ell\ ^{1,3}L) \rightarrow e+He^*$ $(1s\ n'\ell'\ ^{1,3}L')$

  $2 \leq n,n' \leq 4$

  - New calculations: CBE (Shevelko)

    CCC (Bray)

    RM (Bartschat, Burke)

  - Evaluation: de Heer
- Consultancy Meeting: November 1995 (de Heer, Bray, Bartschat, Fon)

2) Be, B-datbase Upgrading

- $e+Be^{q+}$, B^{q+}; EXC, ION, -updates (Clark, Berringrton, Moores)
- $e+Be^{q+}$, B^{q+} + H, H_2, He : EXC, ION, CX - New Calculations; revisions)

  ~ 15 authors

  Publication of new results in:

  Physica Scripta Topical Issue T62 (1996)
- Consultancy Meeting: September 2-3, 1996 (Burke, Bray, Bartschat)

3) Erosion database

- Outcome of the Erosion CRP

- IAEA Role: File Preparation,

ALADDIN Formatting

5. AMDIS and ALADDIN Developments (Status)

- AMDIS (At and Molec. Data Information System)
  - On-line access Operational (via INTERNET/Telnet)
  - Associated Documentation (Manuals, etc.) in final stage of preparation for publication (draft prepared in May-June 1995)
  - WWW home page in preparation
    (AMDIS included also in the WWW home page of NDS-IAEA)
  - Access Statistics recorded (since August 1995)

- ALADDIN
  - No substantial changes in structure
  - Particle-surface interaction dictionary upgraded
  - ALADDIN formatting of evaluated data continued (e.g. particle-interchange reactions, erosion data)

6. International Bulletin on A+M Data for Fusion

- Last issue no. 49, April 1995
- Gap in publication schedule about one year (delay in filling in the P-3 position)
- Vols. 50 and 51 are presently in preparation (with assistance provided by J. Botero)
- Vol. 52 is scheduled for December 1996 (subject to availability of funds)
- CIAMDA-III : in preparation (by J. Botero and J. Stephens)
  - Funds for publication uncertain

7. Data Related Publications

1) Nucl. Fusion A+M Suppl. vol. 5 (1994, Dec.)
   (Compendium on Material Properties Data)
2) Nucl. Fusion A+M Suppl. vol. 6 (1995)
   (Data on Medium- and High-Z Impurities)
3) "Atomic and Molecular Processes in Fusion Edge Plasmas"
   (Plenum Press, N.Y., 1996)
4) "Collision Processes of Be and B Ions and Atoms in Fusion Plasmas"
   (Phys. Scr. T62 (1996)
5) "Collision Processes of Li Atoms with Electrons, Protons, Multiply Charged Ions

and Hydrogen Molecules" (Recommended Cross Section Data)
At. Data Nucl. Data Tables (1996, accepted) (with TUW-group, HP. Winter)

6) Several publications of A+M Data Unit staff in sci. journals

7) Several IAEA-INDC-NDS reports

8. Expert Meetings in 1994-1996

1994 (Nov. - Dec.) - 1995

1) AGM on "Atomic and plasma-surface interaction data for divertor physics design studies" (November 1994; 16 participants)

2) 1st RCM on "Radiative cooling rates of fusion plasma impurities" (November 1994; 8 participants)

3) 1st RCM on "Collection and evaluation of reference data for thermomechanical properties of PFMs" (December 1994; 7 participants)

4) 3rd RCM on "Plasma-interaction induced erosion of fusion reactor materials" (October 1995; 9 participants)

5) 13th A+M Data Centre Network Meeting (AGM) (July 1995; 14 participants)

6) 1st RCM on "Tritium retention in fusion reactor PFCs" (October 1995; 5 participants)

7) 1st RCM on "Atomic and plasma-wall interaction data for divertor modeling (November 1995; 10 participants)

8) CM on "e-Impact excitation cross section data for He*" (November 1995; 4 participants)

1996

1) 2nd RCM on "Collection and evaluation of reference data for thermomechanical properties of fusion reactor PFMs" (March 1996; 6 participants)

2) TCM: 9th IFRC A+M Subcommittee Meeting (July 1996)

3) 2nd RCM on "Radiative cooling rates of fusion plasma impurities" (October 14-15, 1996; 9 participants (expected))

4) CM on "Electron impact collision processes of Be and B ions" (September 2-3, 1996; 3 participants (expected))

5) CM on "Preparation of the Handbook on erosion data for fusion" (October/ November, 1996; 4 participants (expected))

9. Programme Plans for 1997-1998

1) CRPs to initiate:

1^{o}/ CX data for modeling and diagnostic applications (1997)

2^{o}/ Molecular data for edge modeling and diagnostics (with emphasis on H_2 and N_2(?)) (1997)

2) **Databases:**

- Continue the establishment of He, Be, B databases
- Start N/N_2 database
- Thermomechanical properties database (compendium) (1997)
- Hydrogen retention/release database (1997-1998)

3) **Further developments of AMDIS/ALADDIN**

- ADAS/ALADDIN conversion

4) **Experts Meetings**

1997

1^{o}/ 14th A+M Data Centre Network Meeting (in "blue book")

2^{o}/ 2nd RCM on "Atomic and plasma-wall interaction data for divertor modeling"

3^{o}/ CM/TCM on "Atomic data generation for fusion research" (Satellite to 20th ICPEAC) (**Not** in "blue book")

4^{o}/ CM: CX data for fusion plasma studies (CRP scope definition) (not in "blue book")

5^{o}/ CM on Status of plasma-induced erosion data for fusion reactor materials

1998

1^{o}/ 1st RCM: Molecular data CRP (H_2, N_2 ?)

2^{o}/ 10th IFRC A+M Subcommittee

3^{o}/ 1st RCM on CX data for fusion plasma studies