International Atomic Energy Agency

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INDC INTERNATIONAL NUCLEAR DATA COMMITTEE

# IAEA Technical Committee Meeting:

# 12TH MEETING OF THE IFRC SUBCOMMITTEE ON ATOMIC AND MOLECULAR DATA FOR FUSION

**8-9 May, 2000, IAEA Headquarters**
**Vienna, Austria**

# SUMMARY REPORT

**Prepared by: R.E.H. Clark**

December 2000

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

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## Abstract

This report briefly describes the proceedings, conclusions and recommendations of the 12th Meeting of the Subcommittee on Atomic and Molecular Data for Fusion of the International Fusion Research Council held on May 8-9, 2000 at the IAEA Headquarters in Vienna Austria. The report includes the Executive Summary of the Subcommittee from this Meeting which was communicated to the IAEA Director General as well as the report on the activities of the IAEA Atomic and Molecular Data Unit for the period June 1999 - May 2000.



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December 2000

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## 1. INTRODUCTION

The 12th Technical Committee Meeting of the Subcommittee on the Atomic, Molecular (A+M) and Plasma-Material Interaction (PMI) Data for Fusion of the IAEA International Fusion Research Council was held on 8-9 May, 2000 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 data for fusion in the period May 1999 - May 2000 and provide recommendations to the Agency regarding its programme for the years 2001 - 2002 and beyond.

The meeting was attended by eight (out of ten) Subcommittee members (see Appendix 1) including one new recently nominated member, Dr. M. Crisp (United States Department of Energy) and the former head of the A+M Data Unit, Dr. R. Janev (Macedonian Academy of Sciences). Dr. N. Peacock was unable to attend due to medical considerations and Dr. R. Guirlet was unable to attend due to budget restrictions. The Meeting was also attended by R. Clark, Head of the A+M Data Unit, who also serves as secretary to the Subcommittee and J. Stephens, staff member of the A+M Data Unit.

## 2. BRIEF MEETING PROCEEDINGS

The meeting was opened by the Scientific secretary of the meeting, R. Clark, who welcomed the participants and, in particular, the new Subcommittee member, Dr. M. Crisp and the at-large membership of Dr. R. Janev. Next Dr. D. Muir, Head of the Nuclear Data Section, the Section to which the A+M Data Unit is attached, welcomed the Subcommittee and addressed the meeting. Dr. Muir gave a summary of the recent personnel changes in the Unit which are the appointment of R. Clark as the new Head of the Unit and the G-5 position in the Unit to which Khalid Sheikh has been appointed. Dr. Muir gave a summary of the current administrative activities having an impact on the Unit, the most significant of which is the expressed intent of decreasing the overall number of Co-ordinated Research Projects (CRPs). Dr. Muir also noted that there is some desire within the Agency to see the A+M Unit develop some non-fusion related projects, for example in areas such as medical applications and material effects from radiation.

Following the address of Dr. Muir, the Subcommittee took up the task of selecting an alternate chairman due to the absence of Prof. N. Peacock. Dr. W. West (General Atomic, USA) agreed to accept the position for the duration of the meeting. The agenda was discussed and accepted with slight modification (see Appendix 2).

During the first session R. Clark briefly outlined the activities of the Unit during the period of May 1999 - May 2000. Because his appointment began in August 1999 some of these activities took place under the direction of Dr. R. Janev. The topics covered included Co-ordinated Research Projects, Advisory Group Meetings, the Data Centre Network, Consultant Meetings, the extra-budgetary project, the upcoming Project Performance Assessment Process, publication activity, the databases maintained by the Unit, the scientific interactions of the Unit staff, and personnel matters within the Unit. The outline covered the major points included in the report on the Unit activities (see Appendix 3) which had been distributed electronically to the Subcommittee members prior to the meeting. Considerable

discussion took place on many of these topics with helpful suggestions that will be summarized in the Section on meeting conclusions and recommendations.

J. Stephens gave a presentation on the current status of the web-based access to the Unit databases, the progress in the work on moving the bibliographic database to a similar interface and the status of the extra-budgetary item on "International database on irradiated nuclear graphite properties". Dr. Stephens gave a very concise description of the web-based numerical databases including statistics of the usage of the system, which is quite high. He then presented an overview of the planning that has taken place for moving the bibliographic database to a modern web-based approach, rather than a Telnet interface. He pointed out that the moving of the Unit's workstation inside the Agency Firewall will make it difficult to use the Telnet connection in the future. The current status of the extra-budgetary project on irradiated graphite was summarised including the financial arrangements and the production of the CD-ROM version of the database.

Considerable discussion took place on the effect of the Agency policy to decrease the number of CRPs it is undertaking. It was strongly felt that the CRPs represent perhaps the most important activity of the Unit. A statement on the recommendation of the Subcommittee appears in the Executive Summary and in the meeting conclusions and recommendations.

The second session of the meeting was devoted to a discussion of the current priorities and areas of activity for the 2001-2002 time period. The main focus of discussion was on the upcoming CRPs on plasma diagnostics and molecular processes. It was felt that the role of charge exchange would be important in the plasma diagnostics CRP and thus some members of that CRP would participate in the new CRP as well. Several topics were discussed in detail for the molecular processes CRP. It was suggested that some aspects of tritium retention in walls could be incorporated in that CRP. It would also be possible to include some aspects of surface interactions in the CRP as well.

The third session was devoted to a discussion of the proposed Technical Committee Meeting on A+M/PSI Data for Fusion Reactor Technology for the year 2001. The previous such meeting was held in Cadarache in 1992. The objective of this meeting is to bring together experts in fusion technology to provide advice on the needs of the community in A+M data over the next several years. It was felt that this meeting will occur at a pivotal time in fusion research. The suggested location for the meeting is JET. The Subcommittee has recommended that the Unit Head contact JET to discuss the possibility of the meeting being located there. The time for the meeting was recommended to be in October of 2001. The IFRC Subcommittee will serve as the program committee for this meeting. The Unit Head will provide preliminary suggestions for the programme. It was suggested that invitations include a range of people such as laboratory officials, researchers on large machines, data producers, and data centres. It was recommended that the meeting closely follow the format of the previous meeting.

The fourth session focused on the recent ICAMDATA meeting. Of particular note was the proposal at that meeting to begin a discussion of the possibility of developing the capability for one Internet search engine to access different databases from different Data Centres, and locate a requested process on all the databases which have information on that process. It was noted that the A+M Unit has already begun a preliminary investigation on the feasibility of this in collaboration with D. Humbert of the GAPHYOR Data Centre. The A+M

Unit will provide Humbert with information on the format of the input and output streams from the Unit web interface, from which Humbert will be able to produce a piece of software that should be able to run on the GAPHYOR system and make remote queries of the Unit database. It was noted that the Unit should take an active and leading role in this topic within the ICAMDATA framework.

During this session discussion on the editorial board of the "Atomic and Plasma-Material Interaction Data for Fusion" (APID) publication series took place. It was noted that some members on the Board had served since the inception of the publication in 1989. The Terms of Reference for the Board (see Appendix 4) were reviewed. It was proposed to review the current makeup of the Board and to add several new Board members. Members from the Subcommittee on the editorial board are E. Menapace, T. Kato, R, Janev, Y. Martynenko, and J. Roth.

The fifth session dealt with the topic of the upcoming Project Performance Assessment System. The A+M Unit will be included with the fusion portion of the Physics Section in the assessment. The Unit provided the Subcommittee with a preliminary version of the Terms of Reference (see Appendix 5) for this process. The proposed scheduling of the process was outlined and the proposed panel members were cited. It was emphasized that the presentation by the Unit will be extremely important in the process. It will also be important to have a strong presentation to the panel in the background paper which will be provided to the panel before the meeting, which is scheduled for September 2000.

The sixth and final session was to form conclusions and recommendations. During this session the budget of the Nuclear Data Section (NDS) was compared to the recommendation of the previous meeting of the Subcommittee. It was found that the major difference was in not extending the CRP on mixed wall interactions. It was proposed that in the 2002 budget a request be made to begin a new CRP on tritium retention. Also, it was proposed that the 2002 budget contain two AGMs on topics partially to be determined by consultant meetings held in 2001.

## 3. EXECUTIVE SUMMARY (Prepared by W.P. West)

The IFRC Subcommittee on Atomic and Molecular Data for Fusion met at the IAEA headquarters in Vienna, Austria on May 8-9, 2000. The Subcommittee normally meets every two years, but due to a change in the budget cycle of the IAEA, it is changing from holding its meeting on the odd numbered years, to the even numbered years. The last meeting of this Subcommittee was held one year ago. The Subcommittee members in attendance were M. Crisp, R. Janev, T. Kato, Yu. Martynenko, E. Menapace, J. Roth, T. Shirai, and W. West. Also attending were IAEA data unit staff members R. Clark and J. Stephens. Subcommittee member N.J. Peacock was unable to attend for personal reasons, and R. Guirlet was unable to attend due to budget restrictions.

The meeting was brought to order by the new head of the Atomic and Molecular Data Unit (A+M Unit) of the IAEA, Dr. R. Clark. He introduced Dr. Doug Muir, Section Head of the IAEA Nuclear Data Section. Dr. Muir gave a brief summary of the administrative activities of the last year and officially introduced Dr. Clark to the committee. Dr. Clark

assumed his duties as the head of the A+M Data Unit since that last meeting of the Subcommittee.

Dr. Muir pointed out that the IAEA considers dissemination of scientific information and services a very important aspect of its program. He also mentioned the commitment of the Agency to continuing strong external reviews of its various programs.

For the year 2000, he pointed out that the Agency has put pressure on the Data Unit to reduce the number of Co-ordinated Research Projects (CRPs). He also told us that the Data Unit has been requested to explore the possibility of initiating a database on the interaction of radiation and matter, including radiation effects on solids, atoms and molecules, and biological matter.

Following Dr. Muir's brief statement, Dr. Clark introduced a new member of the Subcommittee, Dr. Michael Crisp of the United States Department of Energy. He then pointed out that the person elected chairman of the Subcommittee at last years meeting, Dr. N. Peacock, was not able to attend this year. The committee elected Dr. W. P. West of General Atomics, San Diego, as alternate chair.

Drs. Clark and Stephens then reviewed the activities of the Data Unit during the last year. The continued publication of the data unit's basic data base and bibliographies is viewed as highly important by the Subcommittee. The Subcommittee also fully supports the goal of full data base access over the world wide web. Two new areas of focus are particularly notable. The first is the effort to participate and take a leading role in creating linked access and usage of the various atomic and molecular data base efforts from around the world, including its members of the Data Centre Network. While the technical emphasis of these various data bases are different, and little direct overlap exists, a transparent linkage of these data bases would be very valuable to a research scientist or engineer in need of atomic and molecular data. Attendance by the data unit staff at the ICAMDATA-2000 meeting is seen as an important part of maintaining the relations with other data centers.

The other new "extrabudgetary" effort is the contract to a small consortium of nuclear power agencies to provide a database on irradiated nuclear graphite properties. The Subcommittee supports the Data Units effort to market its' capabilities and to expand its budgetary base. It also recognizes the need to respond to the external funding Agency's desire to keep some data proprietary. However, where reasonable, the Subcommittee recommends that the data unit make an effort to maintain open data access.

The Subcommittee also discussed the upcoming Program Performance Evaluation (PPAS). The Subcommittee believes that one member of the review panel should have some familiarity with atomic and molecular data issues, and recommends Dr. Ron McKnight, of the United States Department of Energy, as a very good candidate.

The Subcommittee supports the IAEA Technical Meeting on Atomic and Molecular Data for Fusion Reactor Technology planned for 2001. The Subcommittee suggested that a site near the JET facility, in the vicinity of Oxford, England, would be reasonable.

Finally the Subcommittee feels that two issues were of sufficient importance to the continued success of the Data Unit, that we have separated documentation of our discussion

into separate sections, which follow this summary. These issues concern (1) the membership of the editorial board of Atomic and Plasma-Material Interaction Data for Fusion and (2) the limitation of Co-ordinated Research Projects.

Editorial board of Atomic and Plasma-Material Interaction Data for Fusion

The current editorial board for the IAEA published journal "Atomic and Plasma-Material Interaction Data for Fusion" consists presently of 13 members, many of whom have served for almost 10 years. Several of the existing board members have retired from their research positions. At last year's meeting the committee suggested that the board members should be polled by the committee chairman, Dr. Ron McKnight, to learn which members wished to continue their service. The results of this poll were not completely reported in the official summary report (INDC(NDS)-404). This year the committee feels strongly that the board membership should be revised. New members should be appointed to provide the board the capabilities needed to adequately advise the A+M unit on editorial issues and to assist the editor in the refereeing process. Specifically, the members of the board should be highly qualified members of the research community reflecting both the international membership of the IAEA and the topical content of the journal. The board should consist of up to 15 members. In addition, there should be substantial representation from this committee on the board.

The following people from the existing board have indicated a desire to remain active:

R. Janev, Macedonian Academy of Sciences (presently at NIFS, Tokai, Japan)
Yu. Martynenko, Kurchatov Institute, Moscow, Russia

The committee has elected three new members from its own ranks:

E. Menapace, ENEA, Bologna, Italy
T. Kato, NIFS, Toki, Japan
J. Roth, Max Planck, IPP, Garching, Germany

We recommend that the A+M Data Unit first determine from Dr. McKnight who on the present board wishes to remain active. The Unit should then distribute this information to the Subcommittee via e-mail and request nominations for new members. These nominations should be collected and distributed, again by e-mail, to the Subcommittee, and the Subcommittee polled to elect an appropriate number of new members.

Co-ordinated Research Projects

Dr. R. Clark and Dr. D. Muir have reported to the Subcommittee that for the budget year 2001 the A+M Data Unit has been asked by the IAEA to reduce the number of active CRP's. The planned budget has not been reduced, but rather the guidance to the Unit from the IAEA is to use the resulting funds to increase the AGM advisory activities. Thus it appears to the Subcommittee that the IAEA, as a matter of policy, is emphasizing AGMs at the expense of the CRPs. The Subcommittee notes that its previous recommendation to extend the CRP's on charge exchange cross sections and on plasma interaction with mixed material surfaces is not being executed.

This committee believes that the CRP activity is much more responsive to the A+M Unit's needs compared to an AGM. A CRP is active over a three year period. Its activities include the accumulation of new data, a review of the data, and a detailed recommendation on database needs in a specific technical area. The product is a direct roadmap for the Unit to follow as it meets the international fusion communities needs in the specific area. The CRPs have a long track record of being very productive for the A+M Data Unit. An AGM is active for only one meeting. Typically an AGM only provides the Unit with advice in a specific area of fusion research. Often, the advice of an AGM is that the Unit should initiate a CRP in a specific area. In the past, the A+M Data Unit has functioned very efficiently with three to four simultaneously active CRP's. This committee feels that it will be most effective if the Unit's budget and planning reflects this successful history. A reduction below the level of three CRPs will seriously impair the ability of the agency to respond to the needs of the fusion research program. Specifically, we recommend that in addition to the two CRP's planned for 2001 on (1) collisional data for molecular processes in edge plasmas, including surface interactions and (2) atomic and molecular data for fusion plasma diagnostics, a third on tritium retention in fusion reactors be added as soon as possible.

Respectfully submitted on behalf of the Subcommittee,

William Philip West
Alternate Chairman

## Appendix 1

IAEA Technical Committee Meeting:
12th Meeting of the IFRC Subcommittee on Atomic and Molecular Data for Fusion

8-9 May 2000, IAEA Headquarters, Vienna, Austria

### LIST OF PARTICIPANTS

| | |
|---|---|
| Dr. J. Roth | Max-Planck-Institut für Plasmaphysik, Boltzmannstrasse - 2, D-85748 Garching bei München, Germany |
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**I.A.E.A.**

| | |
|---|---|
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## Appendix 2

IAEA Technical Committee Meeting:
12th Meeting of the IFRC Subcommittee on Atomic and Molecular Data for Fusion

8-9 May 2000, IAEA Headquarters, Vienna, Austria

### MEETING AGENDA

Monday, May 8 **Meeting Room: A-22-10**

| | |
|---|---|
| 09:30 - 10:00 | Opening. Welcome to new Subcommittee members.<br>Adoption of Agenda |
| *Session 1:* | *General Report on Activities since May 1999* |
| 10:00 - 10:40 | Report on the activities of A+M Data Unit |
| 10:40 - 11:00 | Discussion of aspects of the Report such as Publications, Meetings, Status of CRP's, Status of databases (access, etc.), Co-ordination of Data Centre Network. |
| 11:00 - 11:30 | *Coffee break* |
| 11:30 - 12:30 | Programme implementation assessment.<br>Agency Policy and its effect on the A+M Data Unit programme (staffing, finances, etc.) |
| 12:30 - 14:00 | *Lunch* |
| *Session 2:* | *Review of Activity Plans for 1990-2000 and 2001-2002 Programme Periods* |
| 14:00 - 15:30 | Current Priorities and Areas of Activity, 2001-2002, for A+M data in the Fusion Programme - a general discussion - see attachments to INDC(NDS)-404. Short term activities e.g. "CX" data, "Diagnostics" and "Molecular Data". Suggestions/proposals for possible longer-term activities. Advisory Group Meetings, e.g. "Tritium Retention". |
| 15:30 - 16:00 | *Coffee break* |
| *Session 3:* | *2001-IAEA Technical Meeting on Atomic and Molecular Interaction Data for Fusion Reactor Technology* |
| 16:00 - 17:30 | Discussion of the Meeting - Objectives, venue, programme, participants, finances, potential sponsorship by IAEA. |

Tuesday, May 9 **Meeting Room: A-22-10**

*Session 4:* *Data Centre Network Activities*

09:00 - 10:30 Activity status assessment and recommendations. ICAMDATA-2000 meeting report. Universal search engine for co-ordinating separate global databases.

10:30 - 11:00 *Coffee break*

*Session 5:* *Business Matters*

11:00 - 12:30 Programme Performance (PPAS) Evaluation Committee on IAEA activities.

12:30 - 14:00 *Lunch*

*Session 6:* *Meeting Conclusions and Recommendations for Activities during the next budget cycle*

14:00 - 16:00
- Summary of meeting conclusions and recommendations
- Executive Summary of the Meeting

16:00 - *Adjournment of the Meeting*

**Appendix 3**

# Report on the Activities of the Atomic and Molecular Data Unit for the Period May 1999 through May 2000

## Co-ordinated Research Projects (CRP)

"Atomic and Plasma-Wall Interaction Data for Fusion Reactor Divertor Modeling" held its second RCM 8-9 March 1999. A Summary Report was issued. Final review papers from the participants are being collected and will be edited by R. Janev to appear in the APID series.

The final RCM for the CRP "Charge-exchange cross section data for fusion plasma studies" will be held on 25-26 September 2000 in Vienna. At that time a Summary Report will be prepared and arrangements for collection of final reviews and data generated by this CRP will take place.

The final RCM for the CRP "Plasma-material interaction data for mixed plasma facing materials in fusion reactors" will be held on 16-17 October 2000 in Vienna. At that time a Summary Report will be prepared and arrangements for collection of final reviews and data generated by this CRP will take place.

Two new CRPs, one on the topic of plasma diagnostics, the other on molecular processes in plasma, will be initiated in 2001. Input on the scope and participants of these CRPs are currently being gathered.

## Advisory Group Meetings (AGM)

On 7-8 June 1999 an AGM on "Critical Assessment of tritium retention in fusion reactor materials" was held in Vienna. A summary report was issued. This meeting was extremely valuable in addressing an area of great importance in future fusion machines. This topic should continue to receive a great deal of attention. It is hoped that a second AGM on this topic will be held in the future and could perhaps lead to a CRP effort in the future.

## A+M Data Centre Network

A meeting of the A+M Data Centre Network was held on 13-14 September 1999 in Vienna with representatives from 10 Data Centres outside the A+M Data Unit present. Each Data Centre representative gave a summary of their current status and views of priorities. The status of the ALADDIN data system and format was reviewed. A new comprehensive list of data needs and priorities was reviewed and compiled and is available on the A+M Data Unit's webserver.

The review of the ALADDIN system at this meeting indicates that the ALADDIN format remains an effective format for transmission of data from different data centres. Most data centres have their own web presentations, which further facilitates the exchange of data.

## Consultants' Meetings (CM)

During this period there were three consultant visits to the A+M Data Unit.

On 6-10 December 1999 Dr. J. Peek from Los Alamos National Laboratory visited the A+M Data Unit. The purpose of this visit was to provide the Unit with some sample calculations of electron inelastic cross sections for ions using the "average approximation" and to compare the calculations from this theory with those from the distorted wave theory. The average approximation theory was developed to be a more rapid computational technique with little loss of accuracy. During this visit Dr. Peek demonstrated a computer code using the average approximation which he installed on the Unit's IBM workstation. Sample calculations were made for a number of transitions in a number of different ions. The comparison of results with available distorted wave calculations was quite good. Dr. Peek then indicated modifications he will undertake to extend the theory to proton impact cross sections, which can be important in fusion plasmas and for which there exist much less data than for electron impact. The assessment of this visit is that it was extremely valuable for the Unit and has the possibility of opening up a new avenue for generation of cross section data of good accuracy for a number of processes for which little data now exist.

On 6-10 December 1999 Prof. C. Greene from the University of Colorado visited the Unit. The purpose of this visit was to give the Unit access to working R-matrix theory computer codes for the purpose of evaluating cross section calculations for atomic processes. Several computer codes were installed on the IBM workstation at the Unit and test cases were run. This set of codes gives the Unit the ability to calculate cross sections for several processes in atomic systems using some of the best theoretical techniques available. This will prove to be of great value in evaluating the accuracy of other cross section calculations submitted to the Unit databases. The assessment of this visit is that it was extremely valuable to the Unit.

On 13-17 December 1999 Dr. Y. Kim of NIST visited the Unit. The purpose of this visit was to provide the Unit more detailed information on the theory and implementation of that theory for the calculation of cross sections for ionization of atoms and molecules. Dr. Kim spent a week reviewing the binary encounter method and demonstrated the effectiveness of this method. He also left with the Unit the FORTRAN language code for the evaluation of such cross sections from physical parameters for each system desired along with a number of sets of these parameters. In the future, as more such parameter sets become available, additional cross section sets can be calculated from the computer code. The assessment of this visit was that it was very valuable in adding to the available amount of cross section data for the Unit.

## Extrabudgetary project

The "International database on irradiated nuclear graphite properties" has now been officially implemented as an extrabudgetary project of the A+M Data Unit. Transfer of the administration of this project occurred during the summer of 1999. The first official meeting of the Steering Committee was held 23-24 September 1999 in Vienna. At the meeting the first version of the CD-ROM database was distributed to the members by Dr. J. Stephens of the A+M Data Unit. Dr. Stephens also provided a manual on the use of the database and provided some examples. The Steering Committee discussed plans for the coming year and assigned priorities for adding to the database. The next meeting of the Steering Committee

will be held in Oak Ridge Tennessee in Sept 2000. A summary report of the first meeting is available.

## Project Performance Assessment System

The A+M Data Unit will be included with the fusion programme of the NAPC Physics Section in a Project Performance Assessment System (PPAS) process during the year 2000. Preliminary meetings regarding this process have already taken place with T. Dolan and U. Schneider of the Physics Section. The A+M Data Unit has given input for the Terms of Reference document that is in preparation and will give detailed reports on the various projects and statistics of usage of the database.

## Publication activity

In addition to the Summary Reports of the various meetings and the extrabudgetary project described above, the Unit has continued in producing its normal publications.

Issue numbers 56 and 57 of the "International Bulletin on Atomic and Molecular Data for Fusion" appeared as a single publication in December 1999. Normally two volumes per year are published, but due to time delays in submissions of bibliographic data from the A+M Data Centres, the two volumes were combined into one volume.

Three issues of the APID series are in preparation. Volume 7B on plasma-surface interactions is in the final stage of preparation. Volume 7B (like 7A) has required a larger amount of effort on the part of the Unit than most issues. The Unit has completed the fitting of all the data to an analytic form so that it can be ALADDIN formatted. Due to the extreme non-linear nature of the fitting functions, this procedure is time consuming, and has also required the formulation of new fitting functions for the energy and angle dependence of the physical sputtering process. This work is now in its final stages and publication should take place within three months.

Volume 9 of APID, resulting from the final review papers from the CRP on plasma-wall interaction data, will be edited by R. Janev during his consultants visit this week. Several very comprehensive manuscripts have been received. Publication of this issue should proceed quickly.

Volume 10, resulting from the calculation of radiative power loss from plasmas is in the preparation stage. The manuscripts have been collected and initial editing has been done. A final version will be produced and printed by the end of 2000, or in the first quarter of 2001.

## AMDIS and ALADDIN

The web-based system for access to the Unit's ALADDIN databases is performing well. Several minor problems have been identified and fixed. The numerical databases are now accessed with great frequency from institutions around the world. Web usage statistics can be easily generated. The Unit maintains the entire system on the IBM workstation. Currently the

database accessible from the web contains over 3700 entries in over 60 categories of data type.

Design and planning of the web-based version of AMBDAS, the bibliographic component of AMDIS, has been completed, and the database programming is in progress. This is somewhat more challenging than the numerical database due to the large varieties of data attributes present in a character-based database, and implementation of a valid relational data model must be adhered to in order to maintain data integrity. Following completion of the database programming, a form-driven, user-friendly web interface will be designed and implemented.

A new method of globally accessing databases was discussed at the ICAMDATA meeting held in Oxford in March 2000. This method would be to enable the interface for one database to make inquiries of other databases. The A+M Data Unit undertook some discussions with D. Humbert of the GAPHYOR Data Centre. Dr. Humbert suggested making a preliminary attempt to allow the GAPHYOR interface to query the A+M ALADDIN system by sending commands directly to the script for the ALADDIN interface. By sending the correct requests, the ALADDIN system could return the relevant information to the GAPHYOR interface, just as if a human user had gone through the web interface. This work is in very preliminary stages, but it may provide a prototype for the system discussed at ICAMDATA.

A large amount of numerical data is being accumulated which should be added to the database and should be accessible through the web interface. Much of this data is being collected from CRP and Consultant Meetings. These data need to be fitted to convenient evaluation functions. In preparation for that, a general fitting computer code has been written and tested. It is expected that this will speed up the process of adding fitted and evaluated cross sections and rate coefficients to the database.

## Interactions with scientific community

During the past year the A+M Data Unit staff have been quite active in the scientific community. J. Stephens attended an ESF meeting in San Feliu de Guixols, Spain on highly-excited electronic states, as well as the ICAMDATA meeting in March 2000. J. Stephens also visited the CFADC at Oak Ridge National Laboratory (USA), and installed a web-site mirror of the ALADDIN system. R. Clark was invited as a speaker at both the "Atomic processes in plasmas" in Reno in March 2000, and the ICAMDATA meeting held in March 2000 in Oxford. Both Clark and Stephens gave technical presentations to a workshop on the Linux operating system hosted by the Nuclear Data Section in December 1999.

In addition both staff continue to be active in technical work in collaboration with researchers in their respective fields. Clark has continued collaborations on cross section calculations with several colleagues. Through these collaborations a set of computer codes for the calculation of atomic structure, optical properties, and collisional cross section calculations are now accessible by the A+M Data Unit. This adds a new capability in evaluation of cross section data submitted to the Unit. It also gives the Unit a new capability in filling out areas of the database on collisional cross sections when needed. Stephens has continued his collaboration with colleagues on the calculation of molecular photoabsorption and photoionization processes needed for the interpretation of high quality molecular beam experiments on small molecules.

**Personnel issues**

R. Clark joined the Unit in August 1999 and thus was not present at the Agency for the first few months of this reporting period. However, his predecessor, R. Janev, left the office very well organized. This coupled with the expertise of J. Stephens and the capabilities of K. Sheikh have made the transition period relatively smooth.

During this review period it was possible to exchange the G-4 position in the Unit with a G-5 position, which carries more responsibility with it. Mr. K. Sheikh was the successful applicant for the G-5 position. It is planned to involve Mr. Sheikh in more data handling and general database work in the Unit.

**Appendix 4**

# PPAS Evaluation of IAEA Subprogramme G.6
# Plasma Physics Applications and Controlled Fusion Research

Terms of Reference

## I. Context

The IAEA conducts periodic evaluations of all its "programmes" and Subprogramme G.6 "Plasma Physics Applications and Controlled Fusion Research" has been chosen for 2000 as part of that process. The activities of Project G.1.04 "Establishment of International Atomic and Molecular Interaction Database" have been added to this evaluation because the main purpose of Project G.1.04 is to supply atomic and molecular data in support of theoretical modeling of fusion energy plasmas.

## II. Evaluation Purpose

**Objectives**: The overall objective of this evaluation is to assess Agency activities involving plasma physics and nuclear fusion research, with respect to achievements of programmatic objectives and to suggest changes that will improve future programme performance. The specific evaluation objectives are to assess the relevance, effectiveness, and impact of the Agency activities, and to make recommendations that will improve the planning and implementation of activities.

**Do you have any other specific objectives that you might wish to include – e.g.,**

- **Assess a particular aspect of the programme activities?**
- **specific issues in programme implementation or in modes and mechanisms used, etc. ?**
- **its interrelationship with other activities elsewhere?**

The evaluation should provide the general assessment of the subprogram as a whole and its particular components and provide proposals/recommendations for improvements of those activities.

**Expected Use**: The evaluation will result in recommendations to improve future programme performance. They will be used to influence the programme planning and execution beginning with the formulation of the 2002-03 Programme and Budget within the context in the programme's strategic directions. Operational adjustments may also be made in the 2001 programme.

- **What, if anything, else?**

**Scope**: This PPAS evaluation will include the Agency activities in Project G.6.01 "Plasma Physics and Fusion Research," G.6.02 "International Thermonuclear Experimental Reactor,"

G.6.04 "Support to Technical Co-operation Activities" and G.1.04 "Establishment of International Atomic and Molecular Interaction Database". A previous evaluation of Subprogramme G.6 was conducted in 1995, so the present evaluation will cover the time period 1995-2000 and provide recommendations for the future programme.

Project G.1.04 includes an extrabudgetary item for the development and maintenance of a database on the properties of irradiated graphite. Since this database is not connected with nuclear fusion in any way it is not appropriate to include this activity in this evaluation.

**Major Issues**: The following major issues have to be discussed:

- How well has the subprogramme met its objectives?
  - * *What* happened as a result of the programme/activity? Were *performance objectives met* or not met? If so, what was *actually accomplished* for the resources expended? If not, *why* not?
- What is the impact of this subprogramme?
  - * What identifiable *results* (outcomes and benefits) did we actually achieve for the resources expended? Who benefited from the programme/activity? What *difference* did it make?
  - * *How well* has the "programme" (generic) performed? *Why* did things happened as they did? Are the programme objectives still *relevant* to Member States?
- What should be the balance between Agency activities in magnetic confinement and inertial confinement fusion?
  - * What fields of fusion research should be emphasized more? What new fields, if any, should be added? Should any fields be de-emphasized?
  - * What types of activities should be increased or decreased? What new types of activities, if any, are recommended?
- What should the Agency do to promote fusion research in developing countries, and to enhance international collaboration?
  - * How can we build support for fusion research activities from the IAEA Member States?
  - * What can the International Fusion research Council (IFRC) do to help? How can the IFRC effectiveness be improved?
  - * Is the Agency co-ordinating its activities with the IEA effectively?
- What specific activities are recommended for the 2002-2003 year Programme Plan?
  - * What *adjustments*, if any, should be made in the programme and/or resources?
  - * What *lessons* should be drawn from past and current experience that applies to the future?

## III. Evaluation Approach/Methodology

This PPAS Evaluations will consist of a set of preliminary activities undertaken by the Secretariat leading up to an external review group, as follows.

**Background Information Paper**: Staff members will gather and summarize information on past activities that are relevant to the evaluation during the specified time interval. These materials will be sent to the Evaluation Panel one month before its meeting. In addition, as

appropriate other materials may be made available upon request to the Review Group during its meeting in Vienna.

**Self-Assessment**: Self-assessments will be conducted within Subprogramme G.6 of all projects, including G.1.04 with the results assimilated and prepared into a Synthesis Paper of for the overall Subprogramme. The results will be provided to the Evaluation Panel one month before its meeting.

**Question: would it be useful to have another activity to gather some information from users and/or clients of this Subprogramme to get first hand direct feedback in terms of its use etc**? A suggestive paragraph along these lines might read:

> Feedback Information: Before the first External Evaluator' Meeting, the Secretariat will obtain feedback from the external stakeholders in other Members States and international organizations through communications and by using information technologies concerning critical aspects of the subprogramme's activities such as usefulness and relevance. The results would be compiled and summarized prior to the convening of the Review Panel.
>
> **[Note: this could be done on a selective, but impartial basis]**

**PPAS Evaluation Panel**: The review of this Subprogramme will be performed by the above mentioned External Review Group (" Evaluation Group"). A panel of experts, which will be selected taking into account the required skill areas and geographical balance, will meet on 4-8 September 2000.

The following documentation will be provided to the members of the Evaluation Group at least one month prior to its first meeting:

1. Terms of Reference
2. Background Information Paper
3. Self-Assessment Synthesis Report
4. List of Panel members
5. Draft Agenda

The Evaluation Group will:

- review and analyse the written information provided before the Panel Meeting.
- participate in the one-week Evaluation Review meeting in Vienna, including briefings by the Secretariat, discussions and analysis of the information received,
- assess the programme performance with the aim of identifying areas of strength and weakness, and providing suggestions for the future, and
- write a report and present the results to the IAEA Secretariat as scheduled.

The Panel should focus on the projects' relevance, effectiveness, sustainability, and impact. A final exit debriefing will be provided on the last day of the Evaluation Group meeting to the Secretariat staff outlining the preliminary evaluation results, including major findings, conclusions and recommendations.

## IV. Evaluation Timetable & Reporting

A schedule of the proposed activities is as follows:

| Related Activity | Due Date | Responsibility |
|---|---|---|
| | | |
| Inform IFRC and ask for nominations | March | Dolan |
| Submit TOR for approval | April | Schneider |
| Contact potential panel members (subject to approval) | March-April | Schneider |
| Start/finalize Self Assessment | May/ | Schneider |
| Approval of panel members | 30 May | Schneider/DDG |
| Send letters to governments of panel members and Panel Members | 30 June | Schneider/DDG |
| Send written materials to Evaluation Panel | 28 July | Schneider/DDG |
| Evaluation Panel Meeting | 4-8 September | All |
| Preliminary draft PPAS report to IAEA staff | 20 September | Panel |
| Agency staff comments on preliminary draft | 29 September | IAEA Staff |
| Submit final report to IAEA | 30 October | Panel |

## V. Resources

The PPAS review will be co-ordinated by U. Schneider with assistance from R. Clark and T. Dolan. Preparatory work, including the Background Information Paper and the Self-Assessment will be done by Subprogramme staff.

The panel will be drawn from ... **[Indicate the overall mix required mix by specifying whether they are from academia, industry, and/or research institutes, governments, and in what overall sector? ]** In addition, Geographical distribution and representation from both developing and advanced Member States will be considered in choosing the experts. The panel should include at least 1 person who has not worked for the Agency before

The Evaluation Panel will consist of 4 experts covering the following skill areas:

- Atomic & Molecular physics for fusion research (G.1.04) and theory
- Inertial confinement fusion
- Magnetic confinement fusion – experiments
- Magnetic confinement fusion – technology and applications

Since the Panel is limited to four people, there will be nobody with primary expertise on plasma applications or plasma theory.

**Drop from the ToR: A more detailed agenda comes later as a separate document for inclusion in the package sent to the Reviewers:**

## DRAFT Preliminary Agenda
## PPAS Evaluation of IAEA Subprogramme G.6
## Plasma Physics Applications and Controlled Fusion Research

4-8 September
IAEA Room A2305

The **meeting agenda** will be:

Day 1 Discussion with Agency staff
Day 2 Private deliberations with possible recall of staff
Day 3 Further discussion and report writing
Day 4 Further discussion and report writing
Day 5 Editing and discussions with Agency staff.

[This needs to be specified but after the ToR is finalized]

In lieu of the following statement "The **materials** listed below will be made available to the Evaluation Panel" consideration needs to be given to what the External Evaluators **need** to know, in order to avoid overdosing them with too much information and material. Then that needs to be broken down to include:

**Briefings** -- Rick will provide an outline in near future

Room Documents:

- Agency MTS
- What does the SEG Report & Working Paper on MP 1 say about this SP?
- Extracts from Annual report (preferably 1999 if published)
- List of Significant publications and reports such as internal reports, TECDOCs, conference proceedings, journal articles, brochures, IAEA Bulletin, etc.

Materials Available upon request:

- Extracts from Blue Book
- Reports of previous internal and external evaluations or assessments
- Information from discussions at scheduled Agency meetings such as advisory group
- meetings (AGMs) and consultants meetings (CMs).
- Draft strategy papers, where available

# BACKGROUND INFORMATION PAPER
**for**
**PPAS Evaluation of**
## Subprogramme G.6
## Plasma Physics Applications and Controlled Fusion Research

**[Note: this is the beginning of a separate paper under this title; see outline previously provided to be used in continuing work on this.]**

### Context

The IAEA has conducted nuclear fusion research activities since 1960, when the Agency's journal "Nuclear Fusion" was begun. The first IAEA Fusion Energy Conference was held in Salzburg in 1961, and since 1974 this meeting has been held every two years. A variety of Technical Committee Meetings (TCMs), Consultants Meetings (CMs), Advisory Group Meetings (AGMs) and Co-ordinated Research Projects (CRPs) are being organized under Subprogramme G.6 "Plasma Physics Applications and Controlled Fusion Research". The International Fusion Research Council (IFRC) is a standing advisory group that meets annually to evaluate IAEA fusion research activities and to provide advice on future activities and policy issues.

### Programme Objectives

The **objective** of Subprogramme G.6 "Plasma Physics Applications and Controlled Fusion Research" is "To promote international collaboration in plasma physics and nuclear fusion research and development through research co-ordination and technical information exchange; to promote spin-off applications; and to help developing Member States improve their research capabilities." The objective of Subprogramme G.1.0.4 "Establishment of International Atomic and Molecular Interaction Database" is "To establish internationally recommended atomic, molecular, plasma-material interaction, material properties and the interaction of radiation with materials databases for use in fusion research and other plasma applications." This follows from the rationale, which states that, "Fusion research and other plasma applications and radiation physics depend heavily on the availability of accurate atomic, molecular, and plasma interaction data."

[What objective for G.1.04?]

### Resources

The **budget** for Subprogramme G.6 (formerly called A.4) declined from 0.661 M$ (1994) to 0.522 M$ (2001), a 21% decrease. The amount available for programmatic activities is equal to the total budget minus the staff costs. This programmatic budget declined from 0.355 M$ (1994) to 0.240 M$ (2001), a decrease of 32%, without accounting for inflation. The Budget for Subprogramme G.1.0.4 for 2000 is 0.303 M$, including one Extrabudgetary project.

# Appendix 5

Terms of Reference of the Editorial Board of
***Atomic and Plasma-Material-Interaction Data for Fusion***
(IAEA APID-Series)

## 1. Preamble

The IAEA owns and publishes the series "Atomic and Plasma-Material Interaction Data for Fusion" (APID-Series) as a regular publication, with a rate of (normally) one issue per year. The scope of the Series includes fusion relevant data information on atomic and molecular collisional and radiative processes, particle-surface interaction processes and physical and thermo-mechanical properties of materials. The purpose of the APID-Series is to provide a medium for direct and rapid communication of the information from above fields to fusion research community. The preparation and publication of the APID-Series is part of the activity of the Atomic and Molecular Data Unit of the IAEA Nuclear Data Section.

## 2. Role and Duties of the Board

The Editorial Board of the APID-Series shall assist the IAEA in determining the scientific scope and policies of the Series, and in maintaining its high scientific quality and fusion relevance. The Board can suggest subjects for topical issues of the Series, provide assistance in the refereeing process and act as adjudicator in situations when the referee opinions are in conflict. The members of the Board are expected to assist in advertising the Series in fusion research community and its reach of the fusion users.

## 3. Composition

The Editorial Board shall consist of up to 15 members, all of whom shall be pre-eminent experts in the research fields from the scope of the Series and/or active data users in the nuclear fusion research. The Head of the Atomic and Molecular Data Unit of the IAEA Nuclear Data Section shall also be member of the Board and shall act as Editor of the Series. The Subcommittee on Atomic, Molecular and Plasma-Material Interaction Data for Fusion of the IAEA International Fusion Research Council (IFRC A+M Subcommittee) shall also be represented in the Editorial Board by up to 5 of its members.

## 4. Member Appointment and Tenure

The 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.

## 5. Methods of Work

The Board as a whole shall not be convening regular formal meetings. Views, opinions and suggestions concerning questions from the scope of its duties the Board Members shall exchange among themselves and to the Series Editor by electronic and conventional communication tools. The Editor shall co-ordinate and facilitate this process of establishing joint views of the Board on particular issues and shall assume the responsibility for their implementation. In particular, the Editor will seek the opinion of the Board regarding the content of the forthcoming issues of the Series.

Occasional meetings of large fractions of the Board Members will be convened at the major regular (usually biennial) international conferences in the fields from the scope of the Series or at the large IAEA experts' meetings. The conclusions of and the views expressed at such meetings shall be communicated to the Editor for their further co-ordination with the views of other Board Members and for implementation.

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