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Minutes of the 25th Meeting of the International Nuclear Data Committee

IAEA, Vienna, Austria

4 - 7 May 2004

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November 2004

Executive Summary

The 25th meeting of the International Nuclear Data Committee (INDC) was convened at IAEA Headquarters in Vienna from 4 to 7 May 2004. As a result of the unexpected demise of Prof. G. Molnár the Committee structure changed slightly; Dr. F. Tárkányi (Hungary), previously an advisor, was asked to join the Committee as a full member for this specific meeting.

The aim of the meeting was to review the activities of the Nuclear Data Section (NDS) covering the period 2002-2003, to evaluate the NDS programme of work for the two-year period of 2004-2005, and to advise on future activities (2006-2007). The presentations and deliberations in plenary and working group sessions led to many conclusions and recommendations which are given in the full report of the meeting. Conclusions of particular significance are given below:

- Specific nuclear data compilation activities undertaken by NDS are unique. INDC members appreciated that more attention is now being devoted to the compilation of charged-particle data for EXFOR. The Committee recommends to consider further improved methods for data storage and compilation for EXFOR. Furthermore, as a result of recent geopolitical changes, especially in Europe, the relevant IAEA and NEA responsibilities need to be slightly readjusted.

- The Committee took note that the data dissemination and international co-ordination of data exchange represent the most important components of NDS activities, and that improvement of services has always been the top priority. The co-ordination role of NDS for NRDC and NSDD is highly appreciated, and should be further strengthened.

- The Committee noted with satisfaction that the data dissemination services of NDS are utilized by scientists working in all parts of the world. These requests pertain to data for all branches of nuclear applications.

- INDC members appreciated that continued efforts are underway in the NDS to update the general purpose libraries. The Committee finds it important that the NDS continues to maintain and update the photonuclear, RIPL, cross-section standards and FENDL-2 libraries (considering that the latter is the Reference Library for the ITER project).

- The Committee members briefly described on-going nuclear data projects in their countries/regions, and also spelt out nuclear data requirements in various fields. While most of these needs are already being considered by the NDS, it is recommended that the NDS expands the range of interests, according to available resources and expertise.

- The Committee reviewed the four on-going Co-ordinated Research Projects (CRPs), viz. *Improved Cross-section Standards, Therapeutic Radionuclides, Th-U Fuel Cycle* and *RIPL-3*, and found their progress to be satisfactory. It recommended urgent initiation of two other approved CRPs, viz. *Data for Neutron Activation Analysis* and *Updated Actinide Decay Data Library.*

- The Committee appreciated NDS efforts regarding nuclear data development related to Ion Beam Analysis. This was in special consideration of requests from both developing and developed countries.

- Based on extensive discussions, the following three new CRPs were endorsed:
  - development of a reference nuclear database for ion beam analysis;
  - minor actinide neutron reaction data for closed fuel cycle reactor concepts;
  - evaluated nuclear data files of charged-particle interactions for medical therapy applications.

  However, in the latter case, many questions remain open. It was recommended to hold first a Consultants' Meeting to define clearly the scope of the CRP. Without a clear concept and scope, the CRP should not be initiated.

- After thorough discussions, the following new DDP was recommended:
  - maintenance and extension of the cross-section standards file.

- The Committee proposed the following two topics for review and further consideration:
  - covariances;
  - characterisation of neutron sources.

- The Committee appreciates the role of educational workshops in attracting younger generations to the field of nuclear data; members expressed strong support for such activities and identified possible important topics for workshops to be held in 2006 and 2007.

- The Committee expressed great dissatisfaction with the current IAEA policy of printing TECDOCs anonymously. Since participants in NDS CRPs devote considerable time and effort preparing these technical documents, the INDC strongly recommends that the names of contributors appear on these reports as due recognition.

- The Committee lauds the competence and flexibility of NDS with regard to nuclear data services. A major effort of the NDS is devoted to the supply of high-quality data for energy production. However, NDS staff are now paying enhanced attention also to data for other applications, such as diagnostic and therapeutic nuclear medicine, neutron activation analysis, ion beam analysis, etc., thus a good balance has been achieved between energy and non-energy related activities.

The INDC emphasises the central role of the NDS in the co-ordination of international nuclear data centre networks and in providing excellent services to all Member States. The Committee finds the nuclear data activities to be well balanced between services and data development work.

S. M. Qaim
Chairman
International Nuclear Data Committee

May 2004

CONTENTS

APPENDICES

WORKING GROUP REPORTS

Working Group 1: Nuclear Data Development

Participants:

R. Jacqmin	CEA	France	Chairman
A.J.M. Plompen	IRMM	EC-JRC	Secretary
J. Chang	KAERI	Korea	
R.A. Forrest	UKAEA	UK	
B.I. Fursov	IPPE	Russia	
K.S. Kozier	AECL	Canada	
B.D. Kuzminov	IPPE	Russia	
A.L. Nichols	NDS	IAEA	
S.M. Qaim	FZJ	Germany	
D.L. Smith	ANL	USA	
F. Tárkányi	ATOMKI	Hungary	
A. Trkov	NDS	IAEA	
A. Ventura	ENEA	Italy	

Schedule

The Working Group (WG1) agreed to the following schedule:

- General comments and remarks on on-going CRPs and DDPs
- Discussion on new CRP proposals
- Discussion on new DDP proposals
- Any other business

I. General comments and remarks on on-going CRPs and DDPs

NDS staff presentations concerning on-going activities and in particular new CRPs and DDPs were well prepared, and the new format adopted for these written proposals is excellent.

The following comments were made.

- Estimates of resource requirements for each CRP would be of interest.
- WG1 would appreciate having a list of (foreseen) participants in order to be able to better judge if the CRP/DDP will be a success.
- Question was raised whether a Quality Assurance programme would benefit the work of the Nuclear Data Section.
- Would be of interest for WG1 to have feedback on on-going and recently completed CRPs from the participants.

II. Discussion on new CRP proposals

II.A. Development of a Reference Database for Ion Beam Analysis

WG1 noted that a good proposal had been prepared by the preceding DDP with the help of an excellent group of participants. The proposed activity was requested by the user community and is of interest to users from both developed and developing countries.

Following a discussion with regard to the scope of the proposal, it was suggested that the title of the CRP should be modified to better reflect the specific area of IBA that is targeted. Such a title could be *"Development of a Reference Nuclear Database for Ion Beam Analysis"*. In addition, questions were raised about the precise scope of the proposal.

Recommendations:

WG1 endorses this proposed CRP with the following two recommendations

1) Title should be changed to *"Development of a Reference Nuclear Database for Ion Beam Analysis"*.
2) Scope should be identified before the start of the project.

II.B. Evaluated nuclear data files of charged-particle interactions for medical therapy applications

WG1 appreciated the introduction to the CRP provided by Prof. P. Andreo, Head of the Human Health Division of IAEA. The need for improved nuclear data was clearly demonstrated on the basis of comparisons between calculated and measured dose-depth distributions.

Several comments and questions were raised.

- Should the project deal with carbon therapy exclusively, or target proton therapy as well?
- Are the standard data formats adequate or is further development required, e.g. for important codes like MCNPX, FLUKA, SHIELD?
- Is the physics modelling sufficiently well developed to tackle the problem at hand?
- Noted that Italy strongly endorses this project.
- Noted that carbon therapy is an emerging technology that is presently limited to two countries (Germany and Japan), and that a new project is underway in Italy.

Following the discussion WG1 arrived on the following recommendations.

Recommendations:

1) An expert group should define the scope of the project to clarify the above-mentioned issues.
2) This expert group should identify the potential benefits for the community.

II.C. Minor actinide neutron reaction data for closed fuel cycle reactor concepts

WG1 appreciates the importance of this project and recognizes the challenge and long-term nature of the endeavor. The project clearly addresses needs expressed by INDC members.

The following comments were made:

- Scope of the project is such that the requirements cannot be addressed within a single CRP.
- Stressed that a new evaluation should be preceded by essential new measurements.
- Noted that several interesting new measurements have been proposed (ISTC, EC, LANSCE) that deserve to be supported by member states and organisations.
- Since inevitably an evaluation of minor actinides will involve only limited differential and integral experimental information, an evaluation methodology must be developed to overcome this deficiency.
- Required evaluation methodology should be tested within the Th-U CRP.
- WG1 suggests that NEA-WPEC be invited to create a subgroup to address the issues of evaluation and measurement priorities related to minor actinides.
- User needs should be documented through the NEA High Priority Request List.

Recommendations:

1) Redefine the proposed CRP according to the guidelines above, in terms of scope, content and deliverables.
2) The multi-phase activity should start with a CRP devoted to encouraging and facilitating measurements.
3) Should consider cross-sections, neutron yields, neutron spectra, fission yields and delayed neutron data.

III. Discussion on new DDPs

III.A. Photon-source database for commercial accelerators used in medical radiotherapy applications

Following points were raised in discussion

- WG1 asserted that the proposal is outside the technical expertise of WG members.
- WG1 questioned whether this DDP would involve appropriate use of limited resources of NDS.
- WG1 took note of the observation that this activity would constitute a service to another IAEA Division.

Recommendation:

WG1 recommends this task be carried out as an exceptional service task, and not as a DDP.

III.B.Maintenance of the neutron cross-section standards

WG1 received this proposal positively. Points raised were as follows:

- The cross-section standards data file should be identified by a suitable acronym as a deliverable of the DDP, i.e., INXSS-20xx (International Neutron Cross Section Standards, version 20xx).
- A five-year cycle for formal updates of the cross-section standards seems appropriate.
- WG1 noted that the project should be a vehicle to engage young researchers for future standards evaluations.
- WG1 acknowledges that the DDP is an excellent mechanism for maintaining the infrastructure for updating of the standards evaluation.
- Furthermore, an on-going DDP provides strong motivation for experimental groups with measurement programmes for the cross sections of interest.
- The on-going CRP should provide exemplary documentation as input to the DDP and as a guide to other future initiatives.

Recommendations:

1) The proposal is endorsed.
2) In addition to the considerations expressed in the bullet points above, WG1 recommends that the scope of the DDP be expanded to encompass the following closely related technical issues:
   a. Secondary standards (eg. for activation)
   b. Update of the thermal cross sections
   c. Refinement of the evaluation procedures
   d. Dissemination of reference measurement procedures
   e. Encourage code developers to allow public use of essential evaluation tools (R-matrix, generalised least squares, etc.).
3) The cross-section standards data file should be identified by its own acronym, e.g. INXSS-20xx (International Neutron Cross Section Standards file, version 20xx).

III.C. Reference database for transport calculations

WG1 notes that there appears to be no user demand for a new code-dependent database for lattice transport calculations. On the other hand, it is important to maintain and update existing multi-group libraries that are in common use (e.g. for WIMS-D, DRAGON...), especially for research reactors.

Recommendations:

1) WG1 does not recommend this DDP.
2) WG1 recommends maintenance of the existing libraries as a support task.

III.D. FENDL-2 maintenance and upgrade

Recommendation:

WG1 felt it was important to continue to maintain the FENDL-2 library, considering that this library is a Reference Library for the ITER project.

IV. Any Other Business

1. EXFOR

At the request of NDS, WG1 discussed the efficiency of EXFOR compilations. The following comments were made:

- WG1 noted that current procedures limit the rate at which new entries can be added to EXFOR.
- WG1 acknowledges the great effort that NDS has made since the last INDC meeting in order to secure an improved compilation capability.
- WG1 recognizes that further improvements require a joint effort of the nuclear reaction data centres.

Recommendation:

Need to consider improved methods for data storage and compilation for EXFOR to achieve a substantial further improvement in response time.

2. Covariances

Issues raised were:

- Covariances are considered important by INDC members.
- Limited progress is being made in adding covariance information to existing libraries.
- Some existing issues of methodology remain unresolved.
- Training of experimentalists and evaluators would be beneficial.

Recommendation:

Possibility of initiating training courses, a DDP, or a CRP should be considered.

3. Characterisation of neutron sources

Issues raised were:

- A database for the primary cross sections up to 20 MeV exists.
- For accurate measurements, full spectral information is required in order to perform state-of-the-art nuclear data measurements. Additional measurements are needed to resolve this point fully.
- No up-to-date document exists, since the release of the IAEA TECDOC (in 1986), in which the potential problems and remedies are summarised.

- Compilation of primary source data above 20 MeV is limited.
- Laboratories with so-called quasi mono-energetic and thick-target neutron sources would benefit from a concerted action.

Recommendation:

Possibility of initiating a DDP or CRP should be considered, and a proposal should be drafted by a group of appropriate specialists.

Working Group 2: Data Dissemination, International Co-ordination and Training

Participants:

P. Obložinský	NNDC	USA	Chairman
C. Nordborg	NEA	France	Secretary
O. Bersillon	CEA	France	
W.M. Costello	NDS	IAEA	
A. Hasegawa	JAERI	Japan	
F. Leszczynski	CNEA	Argentina	
A.L. Nichols	NDS	IAEA	
B. Ošmera	NRI	Czech Republic	
V.G. Pronyaev	NDS	IAEA	
S.M. Qaim	FZJ	Germany	
R. Srivenkatesan	BARC	India	
T. Vilaithong	FNRF	Thailand	
Z. Zhao	CIAE	China	

As constituted, the Group agreed to divide the discussion into three parts in accordance with the Working Group title.

I. Data Dissemination

Bibliographic data

The Working Group noted that the NEA Data Bank expected to continue the publication of CINDA in paper form (including a CD-ROM containing the complete database), and that the NDS would receive about 50 copies free of charge from the NEA Data Bank for distribution to developing countries. In addition, the NDS will distribute its own CD-ROM containing CINDA, EXFOR and Evaluated Data.

The Working Group recommends NDS not to proceed with the publication of any printed form of the CINDA database, and to encourage the user community to make use of the versions available on the Internet and CD-ROM.

The nuclear data centres were discussing the possibility to extend the CINDA database to include also charged-particle data. The Working Group felt that this would be a useful addition to the database and recommends NDS to extend CINDA by adding bibliography information from current EXFOR charged-particle and photonuclear entries.

Experimental data

The potential need for the correction of certain data sets in the EXFOR base, such as (n, 2n) cross sections, was presented. The Working Group recognised the need for an updating of some data sets in EXFOR to avoid use of incorrectly normalised data and recommends NDS to establish a procedure for revising data in need of updating.

Communication with data users/producers

The Working Group noted that the communication between data centres and data users/producers was not always the best possible, for example, in the case of responses to complaints about missing or erroneous data in the EXFOR database.

The Working Group recommends NDS, in cooperation with the other nuclear data centres, to establish mechanisms for effective and efficient responses to users/producers comments and complaints. The NDS EXFOR web pages should also clearly indicate to whom and how users should send their complaints and suggestions.

NDS intends to change its Web home page and to this end would establish a Web forum to discuss different proposals. A suggestion for an applications-driven home page was demonstrated, based on a small database containing relevant information with explanations, links, a search engine, etc. The Working Group welcomed the initiative to update the NDS Web home page, and encouraged the NDS to consult widely and bear in mind the different levels of knowledge of their customers.

The Working Group asks the NDS to maintain on a regular basis Web pages for the Nuclear Reaction Data Centres (NRDC) and the Nuclear Structure and Decay Data (NSDD) networks.

The Working Group recommends NDS to establish a user forum to exchange experience and to facilitate use of the data.

The Working Group recommends NDS to regularly update the document IAEA-NDS-7 containing an index to nuclear data.

II. International co-ordination

Nuclear Structure and Decay Data Network

The Working Group expressed its deep appreciation of recent NDS efforts to provide training for scientists interested in nuclear structure and decay data evaluation activities. These efforts were especially important considering the age and geographical profile of the current community of nuclear strucuture evaluators. The Working Group stressed the urgent need for new evaluators to enter the field of nuclear structure and decay data.

The Working Group strongly encourages the NDS to continue with activities aimed at stimulating new scientists to become involved in nuclear structure and decay data evaluation. It also recommends NDS to consider, if resources allow, acquiring long-term in-house expertise in nuclear structure and decay data evaluations.

Nuclear Reaction Data Centres Network

The Working Group noted with appreciation NDS efforts to assist the NEA Data Bank in handling EXFOR and CINDA data, during the period in which the NEA Data Bank was renewing their nuclear data staff.

The Working Group confirmed that the priority within the network should remain on EXFOR compilations. The NDS is encouraged, in cooperation with other data centres, to establish a master EXFOR database at NDS.

The Working Group recommends NDS to strengthen its coordination role, thus assisting other nuclear data centres to speed up the compilation of EXFOR entries as far as possible, as the usefulness of the EXFOR is directly linked to the currency of the database.

III. Training and Workshops

ICTP-IAEA workshop on nuclear data for reactors

The traditional workshops on nuclear data for reactor applications, organised every second year at ICTP, are much appreciated by the Working Group. The scope of these workshops was considered relevant and unique, and they filled an existing need within the nuclear data and reactor communities.

The Working Group recommends NDS to organise this workshop at ICTP in 2006, trying as far as possible to assure that the computer codes used in the courses are generally available. The Working Group also recommends that the interface between the nuclear data and the reactor physics courses should be better harmonised.

Other workshops and technical meetings

In 2005

When discussing the 2005 workshops, the Working Group expressed its strong appreciation for the continued NDS effort on nuclear structure and decay data in the form of a new workshop. It was given the highest ranking among the proposed workshops for 2005.

Concerning the 2005 workshop on "Nuclear Data for Activation Analysis", the Working Group recommends the inclusion of lectures on underlying experimental nuclear data, evaluation and processing.

The Working Group welcomed the NDS plan to organise a small training seminar in 2005 on the compilation and use of EXFOR data.

In 2006

The Working Group recommends NDS to organise in 2006 a technical meeting on the needs for charged-particle data at low and intermediate energies, including medical, ion-beam analysis, thin-layer activation analysis (TLA), radiation protection, accelerator driven systems (ADS) and astrophysics applications. Such a meeting would provide the basis and ideas for future work of the NDS, including data compilation and evaluation.

In 2007

The Working Group recommends NDS to organise a two-week workshop in 2007 on "Nuclear Data for Medical Applications".

The Working Group also recommends NDS to organise in 2007 either a workshop on nuclear data for transmutation of waste, or a workshop on nuclear structure and decay data. The Working Group expressed a general preference for the nuclear structure and decay data workshop, but left it up to the NDS to decide, based on experience from the nuclear structure and decay data workshop of 2005.

FULL REPORT

25th INDC MEETING
IAEA Headquarters, Vienna, 4 - 7 May 2004

A Opening

A.L. Nichols (Head, IAEA Nuclear Data Section) welcomed INDC members, and handed over to the chairman – S. Qaim. He welcomed everyone, and introduced N. Ramamoorthy, new Director of the Division of Physical and Chemical Sciences, who made the following points: recent death of G. Molnár was a great loss both to science and the INDC; and the need to look at the next two-year programme of work of the NDS (2006/07). NDS performs a very important task, but has low visibility, so the INDC meeting is very important in raising the Section's profile.

A new Deputy Director General for the Department of Nuclear Energy has been appointed, and will need to be familiarised with NDS nuclear data activities. A.L. Nichols noted that the terms of service of all INDC committee members come to an end in December 2004. Because there are so many new members in this current term, he expects to be permitted to re-nominate all members to the committee for another four-year period.

During the first two days, there were presentations from the NDS staff outlining the nuclear data work undertaken from June 2002 to May 2004. Furthermore, the work of the Atomic and Molecular Data Unit within NDS was also presented for information.

The various changes in the committee are:

- G. Molnár died and F. Tárkányi replaced him for this final meeting of the 4-year term; a letter had been sent from INDC to the widow of G. Molnár, expressing the condolences of the Committee and NDS (a floral wreath was also placed during the memorial service).
- D.L. Smith attended as the US advisor; O. Bersillon attended as the French advisor; B. Kuzminov attended as the Russian advisor.

A.1 Chairman's Remarks

The proposed agenda was adopted (see Appendix 1).

A list of the participants is given in Appendix 2.

The Minutes of the 24th meeting were agreed and adopted; one spelling mistake on p.16 was corrected. The Actions from that meeting were considered (see Appendix 3). A number of these actions are designed to promote good communications between specific individuals, and therefore judged to be continuous/on-going. Actions that arose during the course of the 25th INDC meeting are listed in Appendix 4.

B Nuclear Data Section Review

A draft of the document had been distributed prior to the meeting (see INDC(NDS)-455). A series of presentations were made by NDS staff to cover the main issues

in the review. Copies of the presentations were made available to all participants, so details of each are not repeated below; rather the main discussion points are highlighted.

B.1 Budget and Staffing

Both the budget and staffing levels will remain stable in 2002 and 2003, with 11 professionals and 7 support staff, and total costs of approximately $2.3M per annum (zero growth budget as requested by Member States through the Director General). There has also been a shift in emphasis, with more resources devoted to workshops and other training initiatives, and to increasing involvement in technology transfer projects. P. Obložinský asked why so many secretaries are necessary? A.L. Nichols replied that they were necessary because of the significant number of IAEA-sponsored meetings that need to be administered throughout each year. He gave more details about the breakdown in staff costs to show that much of this expenditure is actually directed towards technical projects. Consequently, the real administrative cost is nearer to 35% than the 50% that a preliminary inspection of the figures might suggest. P. Obložinský is worried that since the budget is fixed, any increase in staff salaries means that there will be less money for projects.

A.L. Nichols highlighted the major achievements of the Section over the previous two years:

- successful migration from VMS to a platform-independent relational database environment for the nuclear databases;
- CRP on "Cross-Section Standards" initiated and on target;
- recruitment of a systems analyst, and a dedicated CINDA/EXFOR compiler.

There was a discussion about the technical work of NDS staff being acknowledged by including their names on all future TECDOCs; A.L. Nichols noted there seems to be some progress in achieving this aim, but continued support was required from all INDC members as the Agency explores changes in their anonymity publishing policy. There has been a significant increase in the groundswell of opinion from the nuclear physics community in support of a change to Agency policy for specific documents containing primarily the technical work and associated studies of contributors (external participants and internal scientific staff), with no policy and procedural input of any consequence involving the IAEA.

B.2 Nuclear Data Section Activities (2002-2003)

B.2.1 Network Co-ordination and Databases

V. Pronyaev described the data networks and the new generation of databases (IAEA Nuclear Data Section: Network Co-ordination and New Generation of Databases). He noted that of the thirteen Nuclear Reaction Data Centres, four are core, while the rest are national or specialised. The work of all of these centres is coordinated through organised meetings, visits and memos. The main task through 2002/04 has been the migration of databases to modern relational databases.

There is a similar network of twenty Nuclear Structure and Decay Data (NSDD) centres (including evaluation groups) that also hold meetings under the auspices of the IAEA to co-ordinate their work and organise technical workshops. A notable achievement is that there

are seven possible new ENSDF mass-chain evaluators from Australia, Argentina, Bulgaria, Brazil, India, Russia and USA (four are supported by IAEA individual research contracts), following two NSDD training workshops.

A new generation of nuclear databases are being implemented at all centres. V. Zerkin is responsible for CINDA-EXFOR-ENDF at NDS, and this work has involved collaboration with NNDC, BNL, USA. Major features are: the use of the Web for data retrieval, multi-platform software, and independence from commercial vendors. Work to date has shown this approach to be a universal and cost-effective solution for data centres, laboratories and users. So far CINDA (utilities and Web-retrieval) and EXFOR (CD-ROM) are completed; work is still on-going to port all databases to the Linux MySQL server.

S. Qaim asked if there are any problems with this form of co-ordination. There is still duplication for some new EXFOR entries, and assistance will be needed from NNDC to migrate other databases. However, NNDC appears to be focused on SyBase, rather than open software (to be discussed further in the relevant Working Group).

Since May 2002, NDS has assumed the co-ordinating role in the compilation of EXFOR. The distribution of CINDA is moving to CD-ROMs, although there is a proposal to publish the complete CINDA book (1935-2004) in 4 volumes, and then produce no further hardcopies (rather make updates available only on CD-ROM). S. Qaim noted that about two years ago significant numbers of NEA clients were using the IAEA web site; now there are no password barriers on the NEA site, and this particular usage should decrease. D. Smith asked about the role of the Brazil mirror site: this site was introduced so that Latin American users could obtain nuclear data locally at times when electronic communications with the US or Europe were slow. However, the Brazilian site has only been partially successful. R.A. Forrest asked if progress on compiling EXFOR data was the same in all centres - noted that some centres respond more rapidly than others.

B.2.2 Atomic and Molecular Data Unit

R. Clark gave a brief overview of the work of the Atomic and Molecular Data Unit within NDS. Note that this presentation is for information and completeness only; INDC has no formal role in scrutinising the content of this particular work programme. These data are compiled for adoption in fusion energy applications.

B.2.3 Nuclear Data Development (including Co-ordinated Research Projects (CRPs))

A. Trkov (IAEA Nuclear Data Section (NDS)) gave a presentation entitled: "Nuclear Data Development (2002-2003)", and provided an overview of the CRPs, noting that four were active during the years 2002/03 and are still on-going. One planned CRP was cancelled, with an alternative proposal made for 2006/07. Details are given in the table below. Two DDPs (Maintenance of the FENDL library for fusion applications, and GANDR) are on-going, while the work on the International Reactor Dosimetry File, IRDF-2002 has been completed and the TECDOC is awaiting approval. GANDR aims at analysing the impact of new covariance data on integral results. A. Trkov noted that one practical example had been carried out to prove the methodology. P. Obložinský questioned the relevance of this project, and requested further details be given to the committee. A. Trkov also described work within the FENDL DDP carried out using the DOPPLER module of NJOY to generate ACE libraries at various temperatures for both FENDL-2 and IRDF-2002.

Status of Co-ordinated Research Projects

No	Short title	Duration	Participants (Contracts)	Project Officer	Status
1	Fission yield data < 150 MeV	1997-2002	10 (3)	Lammer	Completed after 1-year extension
2	Reference Input Parameter Library (RIPL-II)	1998-2002	8 (3)	Herman/ Nichols	Completed
3	Update of X- and gamma-ray standards for detector calibration and other applications	1998-2003	8 (3)	Herman/ Nichols	Completed
4	Prompt-gamma activation analysis (PGAA)	1999-2003	5 (2)	Paviotti/ Nichols	Completed
5	Light element cross-section standards (extended to heavy-element standards)	2002-06	9 (3)	Pronyaev	On-going
6	Nuclear data for production of therapeutic radionuclides	2002-06	9(4)	Capote Noy	On-going
7	Validation of RIPL, and implementation in modern nuclear model codes (RIPL-III)	2003-07	4 (3)	Capote Noy	Approved, contracts and agreements pending
8	Nuclear data for Th-U fuel cycle	2003-07	11 (6)	Trkov	On-going
9	Transport simulation for photons/electrons in radiotherapy				Cancelled

B.2.4 Training and Workshops

A. Trkov and A.L. Nichols (NDS) gave a joint presentation: "Training and Workshops on Nuclear Data (2002/03), as sponsored by IAEA". These workshops are held at ICTP, Trieste and IAEA, Vienna, as listed in the table below.

Workshops in 2002-2003

Name	**Venue**	**Dates**
Workshop on Nuclear Reaction Data and Nuclear Reactors: Physics, Design and Safety	ICTP Trieste	25 February – 29 March 2002
Nuclear Structure and Decay Data Evaluation	IAEA Vienna	18-22 November 2002

Name	**Venue**	**Dates**
Workshop on Nuclear Data for Science and Technology: Materials Analysis	ICTP Trieste	19-30 May 2003
Nuclear Structure and Decay Data: Theory	ICTP Trieste	17-28 November 2003

and Evaluation		
Relational Databases for Nuclear Data Development – Dissemination and Processing: EXFOR Implementation, Maintenance and Compilation	IAEA Vienna,	1-5 December 2003

A.L. Nichols noted that the two Nuclear Structure and Decay Data workshops had been particularly successful. S. Qaim asked whether the long-running workshop on Nuclear Reaction Data and Nuclear Reactors, held every two years, was still worthwhile, and whether there was any positive feedback. Most of the attendees are from developing countries, and R. Srivenkatesan felt that this biennial workshop was extremely valuable with several students from India attending. F. Leszczynski was less enthusiastic about student attendance from Latin America, and also felt that these workshops were not well enough publicised.

R. Jacqmin stated that NDS should be congratulated for encouraging decay chain evaluators through holding workshops that give practical training. A.L. Nichols noted that the developed countries also need to get more involved in this area of expertise to replace evaluators who are retiring now. INDC members believed that there needed to be more long-term financial support to encourage greater participation. P. Obložinský believes that US experience shows that students are more easily encouraged into nuclear structure studies rather than nuclear reactions because more research topics (e.g. high-spin physics) are available. These students eventually become active in nuclear structure and decay data evaluation. He believed that Europe must take steps to encourage more evaluators. A. Plompen stated that he would try to solicit support for mass chain evaluations (ENSDF and Nuclear Data Sheets) from the EU. The Committee encouraged the NDS to continue to hold the ICTP Workshops on Nuclear Structure and Decay Data.

S. Qaim asked about the relevance of the Materials Analysis workshop, commenting that it should have been better named "Elemental Analysis Workshop". A. Trkov stressed that the workshop had proofed to be highly popular and relevant, although he agreed that the title was not exact. S. Qaim believed a group in Pakistan would be interested in attending the EXFOR workshop with a view to becoming involved in these compilations. F. Leszczynski noted that these discussions confirm that one of the main objectives of these IAEA-ICTP workshops is to introduce 'new blood' into the nuclear data field.

B.2.5 Computer Operations

L. Costello (NDS Systems Development Unit) gave a presentation on the NDS computer systems over the period 2002/03, including their performance and development. There is a new Compaq ML530 server (replacing the IBM AIX server), loaded with the Linux software required for hosting the new relational databases. The existing VMS Alpha machines will run in parallel until the end of 2005. The Linux setup for the NDS servers is converging towards what is available at NNDC. Costello also noted the collaboration with INIS to convert all NDS paper documents into electronic form (searchable PDF).

S. Qaim asked about progress with the Indian server project. L. Costello stated that, while there has been some progress, the main work will be started as soon as NDS and NNDC have finished the task of migration to relational databases. P. Obložinský asked about the new web services. One of the most important features is the ability for users to search rapidly all the databases without knowing complete details of the individual databases.

C Nuclear Data Needs

C.1 INDC Members: statements on data needs

A short report was prepared by each national representative outlining his country's work and needs in nuclear data.

C.1.1 Argentina

F. Leszczynski has prepared a report which covers Latin America (see INDC/P(04)-4), in his position as representative for all of South America (15 countries). He noted that these countries need data for medical applications and safety studies. Only Brazil and Argentina have reactors, and thus have energy related needs. Other important areas are boron neutron capture therapy, and activation cross sections. Several training needs were highlighted (e.g., the use of MCNP and MCNPX neutronics codes). A. Nichols replied that the report contains a very comprehensive list of requests, and he noted especially the training needs.

C.1.2 Canada

K. Kozier noted that there was no INDC working paper on Canadian work. The nuclear data activities and needs in Canada focus primarily on support for domestic power and research reactor technologies, which are based on thermal-fission reactors operating on a once-through uranium fuel cycle.

Applied nuclear data activities have increased significantly in recent years within Canada, and tend to be application-specific. For example, multiple and distinct multi-group nuclear data libraries (e.g., featuring 89, 120 or 172 neutron-energy groups) based on ENDF/B-VI release 5 data have been prepared to perform WIMS lattice-cell calculations for existing CANDU power reactors and the Advanced CANDU Reactor (ACR), while a 199-group library was prepared for MAPLE isotope-production reactor calculations. Similarly, a new multi-temperature nuclear data library has been prepared to support MCNP MAPLE reactor-core calculations.

However, comparisons of reactor-core calculations with integral critical measurements suggest inadequacies associated with the current nuclear data, specifically:

- Comparisons of the results of MCNP and WIMS coolant-void-reactivity calculations with measurements in the ZED-2 zero-power reactor indicate a small consistent positive bias of roughly 0.7 to 1.7 mk. Additionally, the MCNP k_{eff} results underestimate criticality by about 5 mk.

- Results of MCNP and WIMS-based calculations of the power coefficient of reactivity for the MAPLE reactors disagree with commissioning measurements, even with respect to the sign of the coefficient. Additional measurements have been proposed to clarify the magnitude and uncertainty associated with this discrepancy.

Suspected that the cross-section data file for ^{238}U is the primary contributor to these differences; hopefully, the preliminary new ENDF/B-VII nuclear data will help reduce the magnitude of the observed discrepancies.

Inherent uncertainties associated with the underlying nuclear data are a significant concern for the construction of new nuclear reactor designs, given the large financial and

other commitments involved, as well as the time delay for confirmation derived from reactor-commissioning measurements or specific critical-facility experiments. Hence, clarification of this uncertainty (e.g., based on covariance data from differential cross section measurements) would be a useful augmentation to the nuclear data, provided that the practicability of this approach could be demonstrated.

Concerning the longer term, the proposed Generation-IV nuclear-reactor systems involve new fuel and moderator/reflector materials, for which the thermal-neutron scattering laws (i.e., $S(\alpha,\beta)$) are not currently available in MCNP. Thus, such data need to be derived for all materials of current and probable future interest (e.g., O in UO_2, C in SiC, N in UN, C in UC, etc). Moreover, these data (as well as the unresolved-resonance probability-table data for other important nuclides) should be made available at the temperatures of interest for a particular application.

C.1.3 PR China

Z. Zhao has prepared a report containing the main activities (see INDC/P(04)-8). The background to the data needs for China is:

- According to the national development plan for energy, the capacity for nuclear power will rise to 36 GW by 2020, in comparison with the present capacity of 8.7 GW. This implies a construction rate of 2 GW of nuclear power each year.

- CARR (China Advanced Research Reactor) and BRIF (Beijing Radioactive Ion-Beam Facility) are under construction. The CARR will provide thermal neutrons (flux $8x10^{14}$ n cm^{-2} s^{-1}) for isotope production, NAA, neutron scattering research etc. BRIF will have a 100 MeV/0.2 mA proton beam and a radioactive ion beam.

- With the support of the Chinese government, an action has started to create a nuclear data file for basic research.

The nuclear data needs can be summarised under four headings:

- FBR development: Group constants, pseudo-fission product data and covariance data, covering more materials and extending to higher energies.
- ADS development: nuclear data for minor actinides and target materials up to 1 GeV, and for the Th-U fuel cycle.
- Medical isotope production: neutron capture cross sections for targets such as ^{63}Cu, ^{113}In, ^{165}Ho, ^{164}Dy, ^{165}Dy, ^{166}Dy, ^{168}Yb and ^{176}Lu; (n, p) cross sections for targets such as ^{64}Zn and ^{67}Zn; proton-induced cross sections up to 100 MeV for targets such as ^{64}Ni, ^{68}Zn, ^{70}Zn, ^{114}Cd, ^{124}Te and ^{125}Te.

- Basic research: data such as the basic parameters of nuclides, nuclear decay data, data for unstable targets (for astrophysics), and neutron capture cross sections for NAA applications.

P. Obložinský asked about the status of CENDL-3. Z. Zhao stated that there was as yet no timetable, but he expects this library to be completed by the end of 2005. R. Jacqmin asked about the manpower for nuclear data work; Z. Zhao stated that the data centre has about 30 staff, but including universities and other institutes the probable total is about 100.

C.1.4 Czech Republic

B. Osmera noted that there was no INDC working paper on Czech work. The needs of nuclear data in the Czech Republic are defined by nuclear energetics and various applications of nuclear methods, mainly in human medicine. Six WWER-type reactors are operated in the Czech Republic (2x1000 MW, 6x440 MW electrical). Nuclear and radiation safety and lifetime management, in addition to the end of fuel cycle are all important. Typical work covers core calculations using the WIMS-MOBY DICK (3-D differential code), shielding calculations using the MCNP and TORT codes with ENDF/B-6 and BUGLE96 group libraries. The Czech Republic can contribute to measurements with integral experiments in the LR-0 experimental reactor with WWER-type fuel (no cooling). Some criticality studies and extensive studies of the neutron and photon transport from the core to the biological shielding in the models of the WWER reactors have been performed. He noted that there is still an interest in the creation of a new multi-group library of BUGLE-type, based on the new ENDF/B-VII data. An appropriate CRP was not recommended during the 24th INDC meeting. Nevertheless, other CRPs are relevant for the Czech Republic work with respect to fission safety, spent fuel management and the fusion programme.

C.1.5 France

R. Jacqmin has prepared a report giving details of activities in France (see INDC/P(04)-7). French needs for new or improved nuclear data for fission energy applications can be considered under the following five categories:

- operation of current UOX- and MOX-fuelled PWRs and the associated fuel cycle, including studies of high burn-up fuels and plant lifetime extension;
- innovative LWR and HTR design studies;
- design of the Jules Horowitz irradiation reactor;
- studies of Generation-IV reactors, fuels, and fuel cycles, particularly gas-cooled fast reactors;
- studies of waste transmutation systems.

There can be large differences in the target levels of accuracy depending on the objective, for instance improved economics of an existing plant vs. feasibility study of a future reactor.

These needs imply revised or extended nuclear data evaluations for many nuclides, particularly minor actinides. Requirements include not only neutron cross sections, but also other data such as fission yields and decay data which have to be improved for better mass inventory and decay heat predictions, delayed-neutron data, etc. There is a growing demand for more complete files, particularly gamma-production data and covariance data.

Since the human, experimental and financial resources available internationally are limited, it is important that a rational approach be adopted and a proper balance is found in addressing these needs, with sufficient anticipation to account for the long lead times associated with the production of some data. This translates into the following requirements:

- better assessment of the required accuracies in order to motivate revised evaluations or new (differential or integral) measurements - whenever possible, nuclear data users should assess their needs as precisely as possible, starting from reasonable target accuracies on calculated parameters of interest, and the benefits in terms of economics or safety should be quantified;
- additional international collaboration, particularly in the area of good-quality target sample material procurement, since there is mounting evidence that this is becoming a major stumbling block in performing the most important measurements;
- theoretical physics developments to improve the predictive capabilities of nuclear model codes.

R. Jacqmin elaborated on the importance of well-characterised samples for experiments. S. Qaim asked P. Obložinský about the Oak Ridge National Laboratory service to supply samples. There is a funding difficulty, so it is now extremely difficult to obtain good samples of enriched isotopes. Another possibility is to purchase samples from the Russian Federation, but typically the costs are significantly higher than in the past. D. Smith asked about the ability of various codes to deal with covariance data, and it was noted that there is still room for improvement. Nuclear data users within France (and OECD-NEA) are being asked to assess their needs as precisely as possible, starting from target accuracies on calculated parameters of interest, so that requests for specific revisions of evaluated files can be quantified and the needs for new measurements justified.

C.1.6 Germany

S. Qaim has prepared a report giving details of activities in the Federal Republic of Germany (see INDC/P(04)-3). Nuclear data needs can be summarised under four headings:

- Fusion materials: Dresden and Karlsruhe require intermediate-energy evaluations, transport and activation data for incident neutrons and photo neutron data and codes.
- Diagnosis and therapy in medicine: Jülich and Mainz require charged-particle data up to 100 MeV (both excitation functions and thick target yields), evaluated data for therapeutic nuclides, and decay and production data for emerging radionuclides.
- Radiation shielding, cosmogenic nuclides: Köln and Hannover require medium-energy data.
- Astrophysics: Karlsruhe and Mainz require low-energy charged-particle and neutron data.

C.1.7 Hungary

F. Tárkányi noted that there was no INDC working paper from Hungary. The main needs for neutron nuclear data are as follows:

- dosimetry and monitoring of power and research nuclear reactors;
- accelerator-based neutron sources;

- neutron activation analysis (prompt and delayed).

Data needs for charged-particle reactions are as follows:

- activation cross-section data of light-ion induced reactions at energies up to 100 MeV for medical radioisotope production, for thin-layer activation studies, and for accelerator technology;
- data for ion beam analysis;
- data for astrophysical studies.

C.1.8 India

R. Srivenkatesan has prepared a report detailing activities in India (see INDC/P(04)-11). Nuclear data requirements in India centre around the closed fuel cycle in the Th-U based Advanced Heavy Water Reactor (AHWR) and FBR programmes. India is also designing a Compact High Temperature Reactor (CHTR) based on Th-U fuel.

- India is extensively using the 69 and 172 energy group libraries (supplied by IAEA) for thermal reactor design and safety evaluation (AHWR and CHTR). These libraries require extension to novel materials used in these reactors, e.g. burnable absorbers like dysprosium, erbium etc. - central dysprosium cluster in the AHWR fuel assembly dictates the negative coolant void reactivity, and the reliability of the nuclear data for the major Dy isotopes from different evaluations need to be ascertained. Cold-clean experiments will be undertaken with such a cluster in their Critical Facility.
- Erbium could be used as a burnable absorber in the fuel of CHTR; beryllium is used as reflector - high temperature data of these elements need assessment.
- General data requirements of the Th-U fuel cycle are already being addressed by the on-going CRP, in which India is taking part. AHWR Critical Facility is ideally suited for checking the newly evaluated data for critical reactor physics parameters. Such experiments with Pu+Th MOX and composite (^{233}U+Pu+Th) MOX clusters are planned in the second half of this decade.
- Another area of major attention is the FP and MA data for AHWR and FBR programmes. These data assume importance in the assessment of fuel cycle needs at the back-end, for reprocessing and waste management, as well as re-fabrication. Inventory, radioactivity and toxicity evaluations are required to assess the process and shielding requirements of such plants.
- A number of PIE analyses of thorium fuel from power reactors are being performed; plans are also being developed for PIE of thorium MOX fuels discharged from research reactors. These analyses also require the above data, as well as reliable burn-up markers.
- Some of the above requirements will also be significant in the AHWR case study under INPRO.
- Another growing area of study in India is ADS applications for the thorium cycle. Nuclear data in the high neutron energy range are required for neutronics, shielding, radioactive damage evaluation, etc. to cover both target and blanket regions.

- India participated in the WLUP organised by NDS. When applied to Indian PHWR fuel (natural uranium oxide clusters), usage of the IAEA-recommended libraries (69 group iaea.lib and the 172 group iaeagx.lib) show a remarkable reduction in coolant void and fuel temperature coefficient reactivities, especially with burn-up. This prediction is of great significance for the operation and safety analysis of not only the Indian reactors, but also CANDU units in other countries. Some new benchmarking at high-temperature operating conditions with burn-up is urgently required, and WLUP methodology could be used for this purpose.

- A significant amount of attention has been given to shielding evaluations in the Indian fast reactor programme. Shielding experiments have been performed in a research reactor to simulate fast reactor leakage fluxes. Since measurements in composite shield models showed large discrepancies, experiments with pure materials are in progress, and these studies will be used to assess the nuclear data used in the analysis.

C.1.9 Italy

A. Ventura has prepared a report describing nuclear data activities in Italy (see INDC/P(04)-2). Needs for neutron data are connected with three main fields of research:

- Accelerator-driven sub-critical reactors, in particular the ENEA-CEA-FZK TRADE collaboration within the EUROTRANS network, to be financed in part by the European Commission in the 6th Framework Programme. There are requests for measurements and evaluations of neutron capture cross sections up to 1 MeV, and (n, xn) and neutron-induced fission cross sections up to 250 MeV.

- Fusion devices, involving neutron cross sections up to 50 MeV.

- Astrophysics in which only neutron capture measurements are of interest. No large-scale evaluation work is planned due to the fact that the professional evaluators working at ENEA, Bologna have not been replaced by young researchers.

Needs for charged-particle data are associated mainly with medical applications:

- Production of medical radioisotopes via the Milan-Ispra collaboration by means of proton- and deuteron-induced reactions. Related evaluation work is being carried out at ENEA, Bologna.

- Hadron therapy of tumours - there are increasing needs for proton cross sections up to 250 MeV and heavy-ion (^{12}C) cross sections up to 500 MeV/nucleon. Growing interest in heavy-ion data is connected with the recently approved construction of a facility for heavy-ion irradiation in Pavia, scheduled to commence in five years. Model development for evaluation of heavy-ion data is already in progress at ENEA, Bologna.

C.1.10 Japan

A. Hasegawa gave a presentation on the status of the JENDL project. Data needs are largely driven by the JENDL-4 project, involving interviews with specialists in the application fields of LWR, FBR, shielding, ADS, fusion neutronics, criticality safety, radiation damage, medicine, production of radioactive material for medical use, and astrophysics.

LWR, FBR

- more accurate minor actinide and fission product data,
- re-examination of fission product yield data,
- evaluation of spontaneous fission neutron spectra,
- gamma-ray production data for all nuclei,
- more covariance data.

ADS

- more accurate minor actinide data,
- re-examination of fission product yield data.

Criticality safety

- more accurate minor actinide and fission product data,
- evaluation of gamma-ray production data.

Radiation damage

- evaluation of ^{59}Ni (not present in JENDL-3.3),
- charged-particle, PKA and KERMA data.

High-energy accelerator shielding

- covered by JENDL High Energy File

Fusion neutronics

- resolve known problems with JENDL-3.3,
- comparisons with FNS and OKTAVIAN experiments,
- charged-particle spectra for light nuclei,
- covariance data,
- data for IFMIF will be covered by JENDL High Energy File,
- light charged-particle induced reaction data.

BNCT

- neutron source: Li(p, n), Ta(p, n),
- moderator: Li, F, Al with $E_n \leq 50$ MeV,
- tissue-equivalence: H, C, N, O with $E_n \leq 50$ MeV,
- ^{10}B(n, α) cross section with $E_n \leq 50$ MeV.

The list above covers a wide range of applications. There is also a need to develop nuclear model codes, probably with greater international cooperation. The most important applications involve fission reactors - very large increase in the number of nuclides in JENDL-4 (about 1,000, compared with 337 in JENDL-3.3). For some of the minor nuclides, a whole nuclide file may have to be extracted from another library. A. Hasegawa noted that consideration will also be given to higher-energy data in JENDL-4. A.L. Nichols asked when JENDL-4 would be completed; A. Hasegawa stated that the current end date is 2009. D. Smith asked about standard cross sections - stated that JENDL-4 will use ENDF standards. S. Qaim asked if Japanese work is co-ordinated by the NEA Data Bank - fully co-ordinated and includes participation in WPEC.

C.1.11 Republic of Korea

J. Chang has prepared a report that described the status of nuclear data activities in the Republic of Korea (see INDC/P(04)-12). The main nuclear data need is to support the national long- and mid-term research and development programme; nuclear data activities are also supported from this programme. Important projects in the programme relevant to nuclear data are as follows:

- advanced reactor development (Fast Reactor, High Temperature Reactor),
- advanced fuel development (extended burn-up, thorium cycle),
- utilisation of the Test Reactor (HANARO),
- proton accelerator developments (100 MeV, 20 mA),
- medical cyclotron applications.

Besides the research and development programme, the operation of nuclear plant, the space satellite development project, and radioisotope applications are also requesting improved nuclear data.

C.1.12 Russian Federation

B. Fursov has prepared a report reviewing nuclear data activities in the Russian Federation (see INDC/P(04)-9). Data needs are summarised below.

- Accuracy requirements for microscopic nuclear data are determined from the acceptable uncertainties of the fast neutron reactor functionals shown in the table.

Reactor functional	Acceptable uncertainty (%)
K_{eff}	0.5
Void reactivity coefficient	0.2
Energy production	2.0
Reactivity of control rods	0.02

- High priority constants are required for the investigations of life-extension for WWR and BN reactors, including the calculation of DPA, gas production and the transmutation of materials.
- Measurements of fission cross sections for minor actinides in the resonance energy region and 5-20 MeV.
- Measurements of radiative capture for minor actinides.
- Study of the reason for discrepancies in the average energies of prompt fission neutrons from ^{235}U fission by thermal neutrons, arising from microscopic and integral measurements.
- Measurements of neutron-induced inelastic cross sections for lead and bismuth.
- Experimental improvement of neutron-induced inelastic cross sections for low-lying levels of ^{238}U.

- Measurements of gas production cross sections in (n, t), (n, n'p) and (n, α) reactions to check theoretical curves and/or systematics describing the energy dependence of cross sections.
- Revision of the Russian activation data library (ADL) on the basis of new experimental data, theoretical models and phenomenological systematics.
- Nuclear data for thorium cycle.

C.1.13 Thailand

T. Valaithong noted that there was no INDC working paper from Thailand. Nuclear data measurements at intermediate energy (> 50 MeV) are carried out at the Svedberg Laboratory in collaboration with the Department of Neutron Research, Uppsala University. Measurements have been made of the double differential cross section for light ion (p, d, t, ^{3}He, α) production in the interaction of 96-MeV neutrons with Si, and the resulting data analysed (accepted for publication). Data are also required to test the predictions of reaction models.

The main nuclear data needs are:

- ion beam analysis cross-section library for Rutherford backscattering spectrometry, PIXE and nuclear reaction analysis (including p-γ resonance reactions);
- atomic-molecular cross-section library for low-temperature plasma modelling (for use in industrial applications).

Many linear accelerators are being installed for medical applications in the energy region < 20 MeV, and relevant cross sections are needed in this energy range.

C.1.14 United Kingdom

R.A. Forrest noted that a report of UK work had been prepared (see INDC/P(04)-10). Most nuclear data work is either undertaken as part of the collaborative JEFF programme or through the fusion programme. Within the UK, there is a Nuclear Science Forum (UKNSF) which meets annually and has a web site; UKNSF is funded by the UK Health and Safety Executive (HSE). UKAEA Fusion has responsibility for the EAF activation library which is used in the European fusion technology programme, and now addresses energies from 20 to 60 MeV. These higher-energy data are required for the planned materials test facility (IFMIF). UK industry has also stressed the importance of having covariance data available in the evaluated files. Furthermore, long-term data needs for Generation-IV reactors will need to be addressed.

C.1.15 United States of America

P. Obložinský noted that there was no INDC working paper on work in the USA. The general situation relating to nuclear data in the United States of America and the needs are summarised below.

- Nuclear energy - three projects supported by USDOE-NE (US Department of Energy, Nuclear Energy):
  - lifetime renewal of current nuclear power plants,
  - Generation-IV reactors dealing with the next generation of reactors,
  - Nuclear Power 2010 dealing with the licensing and building of new power plants.

- Other applications (see also below)
  - stockpile stewardship,
  - homeland security,
  - criticality safety,
  - radiation protection,
  - nuclear astrophysics.

US National Nuclear Data Program (funded by USDOE-SC, Department of Energy, Office of Science)

- 25 FTE, 50 heads, budget in Fiscal Year 2004: $5.3 million;
- solid support from USDOE, Office of Nuclear Physics;
- 6.4% increase in funding in Fiscal Year 2005.

CSEWG (funded by several sponsors, including USDOE-SC, USDOE-NNSA and others)

- responsibility for the ENDF library;
- new version of the library (ENDF/B-VII) is scheduled for release in December 2005;
- number of new evaluations covering actinides, minor actinides (LANL), photonuclear library (160 materials), criticality safety (resonance region, ORNL), fission products (BNL-KAERI, 29 materials);
- new Task Force on Homeland Security.

National Nuclear Data Center, BNL

- core facility of US nuclear data activities;
- 12.5 FTE; staff renewal underway - there will be a replacement for V. McLane (end of 2004) and C. Dunford (summer 2005);
- migration project to produce an entirely new webpage in April 2004 (Nuclear Data Portal).

Nuclear data needs:

- National security dealing with stockpile stewardship covering actinides, minor actinides and radiochemical diagnostics.
- Homeland security dealing with attribution (nuclear forensics) and the detection of radioactive materials - USNDP Task Force on Nuclear Data for Homeland Security was established in 2003.
- Criticality safety has data needs particularly in the resonance region – BNL work on fission products under WPEC SG21.
- Workshop on Nuclear Data for Generation IV, April 2003 at BNL highlighted the need for covariance data for Generation-IV reactors - there was a recent request from USNRC for covariance data for five Dy isotopes relevant to the advanced CANDU reactor - AFCI (advanced fuel cycle initiative) also has data needs.
- Radiation protection for space - NASA has data needs, especially for the planned Mars mission.
- Nuclear astrophysics - data needs for neutron capture in the keV region and for structure data.
- New possibilities include the surrogate technique that enables cross-section data difficult to measure directly using RIA (rare isotope accelerators) to be obtained.

Some additional needs were noted by D. Smith:

- production of hydrogen using nuclear power plants (hydrogen initiative);
- data needs for naval reactors (via KAPL – active CSEWG participant);
- INEEL and ANL-West to merge and create primary US nuclear reactor R&D laboratory.

C.1.16 JRC-IRMM

A. Plompen noted that there were reports of the work and needs of the EC-JRC-IRMM unit at Geel, Belgium (see INDC/P(04)-5 and -6). Requirements fall into three categories:

- minor actinide evaluations,
- support of cross-section standards,
- evaluation of need for covariance (DDP/CRP).

A. Plompen noted that Geel will not contribute to the new CRP on activation as they are now measuring threshold reactions.

C.2 Addressing Needs for Nuclear Data Development

A. Trkov and A.L. Nichols (IAEA Nuclear Data Section (NDS)) presented summaries of the CRPs and DDPs current or planned to begin possibly in 2005 to 2007 (including status of emerging TECDOCs). There are four on-going CRPs (see Table in Section B.2.3), and three proposed CRPs (see INDC/P(04)-1, Rev. 1 and Annex 7). Two planned DDPs cover (a) Maintenance of neutron cross-section standards, and (b) Database of commercial proton-source accelerators for medical applications.

P. Obložinský asked how the minor actinide files (produced as part of the CRP on Evaluation of nuclear data for Th-U fuel cycle) will be included in the regional libraries. A. Trkov stated that, as the members of the CRP are most likely to be regional evaluators, they will have access to the freely available CRP data and so these new data will automatically be considered for inclusion in the regional libraries. C. Nordborg and P. Obložinský suggested that WPEC should review the precise requirements (nuclides/reactions) of any subsequent minor actinide work programme; A. Plompen supported the CRP approach. B. Fursov stated that better evaluation of minor actinides could not be undertaken without new experiments, and R. Jacqmin agreed that additional measurements are essential. Further debate of this point should take place through the auspices of appropriate WPEC discussions in 2004/05.

Another proposed CRP is for evaluated files for medical applications. At present such data are created on the fly rather than being found and taken from evaluated data files. S. Qaim noted that, as most therapy employs protons, the users did not want additional data covering heavier particles. While activation by charged particles is presently ignored, this effect is significant and should be studied. Further discussion on this aspect and the DDPs should take place in the relevant Working Group.

D 2004-2005 Programme Review

A.L. Nichols gave a presentation summarising all future work (IAEA-NDS: 2004/05 programme). Six 'project areas' were outlined and are summarised below.

1. Data services, data networks and user support
   - maintain services, provide documentation and 'publicity', and organise workshops,
   - encourage data services in developing countries (e.g., Indian server) and support appropriate conferences,
   - CINDA/EXFOR compilations,
   - organise review meetings (INDC and A+M),
   - network co-ordination meetings.
2. Nuclear data standards and evaluation methods
   - CRP on Cross-section Standards,
   - CRP on RIPL-3.
3. Nuclear data for radiotherapy
   - CRP on Nuclear data for production of therapeutic radioisotopes,
   - maintenance of the website 'Nuclear data for medical applications'.
4. Data for Th-U fuel cycle
   - CRP on Evaluation of nuclear data for Th-U fuel cycle,
   - maintenance of the website 'Safeguards data'.
5. Nuclear data for reactor dosimetry and analysis
   - CRP on Database of prompt gamma rays from slow neutron capture for elemental analysis,
   - CRP on Development of a reference database for neutron activation analysis.
6. Nuclear data for advanced nuclear facilities
   - DDP on Data for advanced systems,
   - CRP on Updated actinide decay data library,
   - develop and support reference library for neutron transport calculations for advanced systems.

E Suggested Activities for Future (2006-2007)

A.L. Nichols described possible future NDS activities that encompass some of the topics described above (IAEA-NDS: Suggested activities for the future (2006/07)). Area 2: RIPL-3 work will still be on-going, while some form of maintenance of the cross-section standards files will need to be on-going and long-term. Area 3: proposed CRP on Charged-particle interactions for medical therapy applications which will be discussed by Working Group 1. Area 4: current CRP on Th-U fuel cycle is due to end in 2007 - user demands in this area means that Working Group 1 should discuss ways of extending this work. Area 5: Working Group 1 should discuss whether the maintenance of the dosimetry library should finish in 2010 or should be continuous. Area 6: needs a discussion on possibility to initiate a CRP dealing with Minor actinide neutron reaction data for closed fuel cycle reactor concepts which could start in 2007. S. Qaim noted that at the last meeting there was a discussion about evaluation of charged-particle data; does this need to be considered by Working Group 1? -

agreed that this topic will be discussed. R. Jacqmin suggested a further topic of discussion for Working Group 1: EXFOR compilation.

E.1 Status and Future of Nuclear Data Networks

Agreed that this topic will be discussed by Working Group 1.

E.2 Workshops

Working paper INDC/P(04)-1, Rev 1, gives details of proposed workshops (see also Appendix 7). Further discussion will be associated with Working Group 2. A.L. Nichols stressed that workshops in the near future had already been agreed with Trieste (for 2005).

E.3 Any Other Business

E.3.1 ND-2004 Conference

Details were given of ND-2004 which will be held in Santa Fe, USA at the Eldorado Hotel from 26 September – 1 October 2004. This ND conference follows meetings of the same title in Tsukuba (2001), Trieste (1997), Gatlinburg (1994), Jülich (1991), Mito (1988), Santa Fé (1985) and earlier meetings. Conference and hotel space has already been reserved, and a local organising committee has been formed. The co-chairs for the ND 2004 conference are M. Chadwick and R. Haight (LANL). A.L. Nichols stated that over 360 abstracts had already been submitted to the organisers of this conference. IAEA-NDS has set aside $18,000 to help fund participants from developing countries; however, there are already thirty applicants, probably about a factor of three too many; however, there is also additional sponsorship funding from Los Alamos National Laboratory.

The next International Conference on Nuclear Data for Science and Technology that will follow on from Santa Fe will be held in France some time during 2007.

E.3.2 Other Conferences

S. Qaim gave details of the 6th International Conference on Nuclear and Radiochemistry to be held in Aachen, Germany from 29 August - 3 September 2004.

F. Tárkányi noted that the 5th International Conference on Isotopes will be held in Brussels, 25 - 29 April 2005.

K. Kozier stated that the Canadian Nuclear Society (CNS) is preparing a bid to host the PHYSOR-2006 conference in Vancouver, British Columbia during September 2006; nuclear data are key factors in most reactor physics issues. The PHYSOR conference bid will be presented to the American Nuclear Society Reactor Physics Division at their annual meeting in Pittsburgh in June 2004.

E.3.3 IAEA Publication Policy

A.L. Nichols mentioned this topic earlier (Section B.1), and there were indications that some progress had been made, but changes in Agency policy would require time and patience.

F Production of Final Reports/Recommendations

Memberships of the two Working Groups were agreed, and rooms allocated. All Working Group discussions were based on the Terms of Reference of the INDC (see Appendix 6). Working Group reports are given at the beginning of this document, while the main points raised in the plenary discussions of these reports are noted below.

G Summary and Concluding Activities

Working Group 1

A.L. Nichols stated that he would not like to see detailed discussions of possible participants in CRPs prior to agreement from INDC and approval by the Agency. He noted that the question of an all-encompassing Quality Assurance programme would be a major undertaking; if the rest of the Agency is not in complete agreement with and practicing the same QA procedures, such an exercise could well prove to be a waste of time and effort. Consequently, he would resist such a proposal from the INDC if applied just to the NDS. Another proposal for INDC to have feedback from the CRP participants would be useful, but there was no such procedure in place; S. Qaim noted that CRP participants had been asked to complete such a questionnaire by the IAEA in the past.

P. Obložinský noted that he had doubts about the usefulness of model code predictions for the CRP on Development of a reference nuclear data base for ion-beam analysis. The scope of this CRP would be discussed during the initiation of this CRP, and that there would be an opportunity to discuss the validity of such proposals at that time with the relevant expertise.

There were reservations on the CRP for Evaluated nuclear data files for charged-particle interactions for medical therapy applications. Further investigations on the scope are needed, and S. Qaim asked if this CRP should be restricted to protons and ^{12}C or should be more general.

The CRP on Minor actinide neutron reaction data for closed fuel cycle reactor concepts was welcomed. However, this large task should have several phases, the first of which involves measurements. Collaboration with WPEC was urged, and will be discussed at a further meeting in a few weeks time. A. Trkov noted that a Consultants' meeting would be able to define the materials and scope of work.

Work on a Proton-source database should be carried out as "an exceptional service task" rather than DDP. No such category of work existed, but A.L. Nichols was happy to undertake such studies on this basis. He reminded committee members that they should also propose their own ideas for various CRPs and DDPs in the future.

The DDP on the Maintenance of neutron cross-section standards was recommended with some additional points. A.L. Nichols asked whether the proposal to re-issue the standards every five years would be a major task. D. Smith believed that such an activity should be manageable, and he also recommended that a meeting of agreed participants should be held every two years.

The discussion on both Covariances and Characterisation of neutron sources resulted in various recommendations. A.L. Nichols replied that NDS would need some time to consider these recommendations. For neutron sources, INDC members pointed out that not all cross sections > 20 MeV exist in the available files to undertake MNCPX calculations of the source spectrum.

Working Group 2

Discussions of Bibliographic data resulted in recommendations to discontinue printed copies of such databases, and to extend CINDA to include charged-particles information. A.L. Nichols agreed to both these recommendations, but noted that co-workers at the NEA Data Bank would need to continue producing hardcopy.

Another recommendation involved the updating of EXFOR data. O. Schwerer noted that a renormalization mechanism already exists, but is seldom used. The subject of delayed EXFOR compilation was discussed. O. Schwerer stated that experimentalists should complain to the responsible centre or NDS if they believed data compilation to be slow. R.A. Forrest suggested that there should be a formal deadline for such data compilations.

A master EXFOR database should be maintained by the NDS. O. Schwerer agreed that this recommendation was sensible, and A.L. Nichols believed this possibility should materialize in the near future. The Working Group also recommended that the NDS co-ordination role be strengthened, and this proposal was positively received.

Detailed information on NDS databases and their communication (and publicity) were discussed. O. Schwerer noted that IAEA-NDS-7 is reasonably up to date, but agreed that this document should be reviewed and updated more regularly than every five years.

Recommendations identified with the Nuclear Structure and Decay Data Network involved continuation of the training by workshops and the possibility of creating in-house expertise. A.L. Nichols agreed but noted that the concept of expecting one (or more) persons to dedicate their time at NDS to mass chain evaluations without strong links to an appropriate measurement programme was unreasonable and runs counter to Network advice on such matters. Several people might become involved part-time. A. Trkov noted that this task is more suitable for a research organisation rather than NDS. P. Obložinský suggested that NDS staff members should not evaluate mass chains, but rather organise external work in this area. There needs to be a more even balance between reaction and structure expertise and work programmes within NDS.

Training discussions involved code availability for course participants at the Workshop on Nuclear data for reactor physics in 2006. There have been some problems with the general availability of SAMMY, WIMS and NJOY. P. Obložinský was insistent that lectures should only be included if the associated codes are generally available, and INDC members agreed with this statement. Recommendations concerning other workshops were all accepted by A.L. Nichols.

The Plenary session resulted in the discussion and agreement of all Working Group recommendations. S. Qaim thanked all Working Group members, especially the chairmen and secretaries, for their good efforts.

S. Qaim presented his Executive Summary. R.A. Forrest reported on the actions from this meeting (Appendix 4), and all were agreed by the meeting.

Any Other Business

S. Qaim hoped that the contacts between INDC members will continue during the two years between meetings, since the INDC should be a living scientific committee.

S. Qaim thanked the NDS for making this a well-planned and organised meeting. A.L. Nichols thanked all the delegates for their participation and for working in an extremely professional manner. He thanked the Chairmen and Secretaries of the Working Groups for their work and pronouncements, also the INDC Chairman and Executive Secretary, and especially NDS staff for their contributions throughout the four-day meeting. The IAEA-NDS secretary has done an excellent job in preparing for and ensuring the meeting was a success. Finally, he endorsed the Chairman's wish that scientific contact be maintained between INDC members. The process of re-appointing INDC members will start no later than the autumn of 2004.

The Chairman thanked A.L. Nichols and NDS staff for their efforts to ensure a smooth, productive and enjoyable four days, and formally closed the meeting.

Appendix 1

25th International Nuclear Data Committee Meeting

IAEA Headquarters
Vienna, Austria

4 – 7 May 2004

Agenda

Tuesday, 4 May

09:00 - 9:30	**Registration**	*(Gate 1)*
09:45 - 10:45	**A. Opening**	*(Plenary, room F-01-25)*
	- Opening statements	
	- Announcements	
	- Statements of INDC members	
	- Adoption of Agenda	
	- Adoption of Minutes of the 24th INDC Meeting (INDC/P(02)-23)	
	- Actions Arising	
10:45 - 11:00	**Coffee Break**	
11:00 – 12:00	**B. Section Review (2002-2003)**	*(Plenary, room F-01-25)*
	B.1 Staffing and Budget	*Nichols*
12:00 – 13:00	**Lunch**	
13:00 – 17:00	B.2 Nuclear Data Section Activities (2002-2003)	
	- Data dissemination	*Pronyaev*
	- Network co-ordination	*Pronyaev*
	- Atomic and molecular data	*Clark*
	- Nuclear data development (incl. CRPs)	*Trkov*
	- Training and workshops	*Trkov/Nichols*
	- Computer operations	*Costello*
(15:00 – 15:30	**Coffee Break)**	
17:30 onwards	**Reception – A23 floor**	

Wednesday, 5 May

08:30 – 09:30 **D. 2004-2005 Programme – Review** *Nichols* *(Plenary, room F-01-25)*

09:30 – 11:30 **C. Nuclear Data Needs** *(Plenary, room F-01-25)*

C.1 INDC members: statements on data needs

C.2 Addressing needs for nuclear data development *Trkov*

(10:00 – 10:15 **Coffee Break)**

11:30 – 12:30 **E. Suggested Activities for Future (2006-2007)** *Nichols* *(Plenary, room F-01-25)*

Status and Future of Nuclear Data Networks *INDC members*

Workshops *INDC members*

Any Other Business: ND2004 Conference; other conferences of interest; IAEA publication policy

12:30 – 13:30 **Lunch**

13:30 – 17:30 E.1 Nuclear Data Development (WG1)
E.2 Data Dissemination, International Co-ordination and Training (WG2)

(15:00 – 15:30 **Coffee Break)**

19:00 onwards **INDC dinner**

Thursday, 6 May

09:00 all day E.1 Nuclear Data Development (WG1)
E.2 Data Dissemination, International Co-ordination and Training (WG2)

F. Production of Final Report/Recommendations

F.1 Discussion of area conclusions
F.2 Drafting of WG reports

Friday, 7 May

08:45 - 12:00 **G. Summary and Concluding Activities** *(Plenary, room F-01-25)*

G.1 Presentation and discussion of WG reports
G.2 Other business
G.3 Adjournment

Appendix 2

International Nuclear Data Committee (INDC)

(Status May 2004)

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Appendix 3

ACTIONS ARISING FROM 24th INDC MEETING

No.	Respondent	Action	Results
1	NDS Head	To distribute copies of the IAEA Addresses of Missions book to INDC members.	Completed, but repeat with new edition
2	NDS Head and the INDC Chairman	To send letters of thanks from the INDC to former members of the committee.	Completed
3	INDC participants	To promote contacts with the National Authorities and their national representatives on the Agency's policy-making bodies: continuous, on-going action.	Continuous
4	NEADB and JAERI	If possible, ensure that there is participation from their organisations in the IRDF-2002 project.	There was participation from both organisations – project has been completed.
5	NDS and other data centre representatives	Discuss and resolve procedural problems with other data centres on EXFOR compilations.	Meeting was held in Paris to discuss problems (mid-2002); progress made at NDS by employing new person dedicated to this compilation task.

Appendix 4

ACTIONS ARISING FROM 25th INDC MEETING

No.	Respondent	Action
1	NDS Head	To distribute copies of the IAEA Addresses of Missions book to INDC members.
2	NDS and other data centre representatives	Discuss and resolve procedural problems with other data centres on EXFOR compilations.
3	A. Plompen	To seek support for mass chain evaluations (ENSDF and Nuclear Data Sheets) from the EU. [Secretary: information sent mid-June to Mr. U. Waetjen at EU Brussels; however, there was a negative response]
4	INDC participants	Disseminate details of all IAEA/ICTP Workshops (Trieste and Vienna) to people in their countries.

Appendix 5

List of Working Papers for 25th INDC Meeting

No.	Author	Title
INDC(NDS)-455	A L. Nichols (editor)	Report of the IAEA Nuclear Data Section to the International Nuclear Data Committee for the period January 2002 – December 2003
INDC/P(04)-1, Rev 1	A L. Nichols	Draft Proposals for IAEA CRPs/DDPs and 2005 ICTP Workshops
INDC/P(04)-2	A. Ventura	Report on nuclear data activities in Italy (from May 2002 to April 2004)
INDC/P(04)-3	S.M. Qaim	Brief report on nuclear data activities in the Federal Republic of Germany for the period May 2002 to April 2004
INDC/P(04)-4	F. Leszczynski	Activities related with nuclear data in Latin America
INDC/P(04)-5	A. Plompen	Report to 25th INDC meeting
INDC/P(04)-6	A. Plompen	Remarks concerning the agenda points
INDC/P(04)-7	R. Jacqmin	Nuclear data activities in France for the period May 2002 – May 2004
INDC/P(04)-8	Z. Zhao	Status report on nuclear data activities in China 2002-2003
INDC/P(04)-9	B.I. Fursov and B.D Kuzminov	Review of nuclear data activities in the Russian Federation from May 2002 to April 2004
INDC/P(04)-10	R.A. Forrest	UK data studies during 2001 and 2002
INDC/P(04)-11	R. Srivenkatesan and S. Ganesan	Indian nuclear data activities and perspectives
INDC/P(04)-12	J. Chang	Status of nuclear data activity in Korea, 2002-2003

Appendix 6

Terms of Reference of the International Nuclear Data Committee

FUNCTIONS

1. The International Nuclear Data Committee (INDC) will advise the Agency on its programmatic activities in the field of nuclear data for applications. In particular, it will:

(a) provide feedback on current activities in the Agency's subprogramme on Nuclear and Atomic Data ("the subprogramme") in order to ensure that the important data needs of Member States are being met;

(b) make specific recommendations regarding future programmatic activities of the Agency in this field and for the efficient and effective implementation of those activities; and

(c) facilitate the exchange of information on nuclear data programmes in Member States.

MEMBERSHIP

2. Members of the INDC will be appointed by the Deputy Director General responsible for the subprogramme, in consultation with their Governments, for an initial term of 4 years, with a maximum of two renewals foreseen.

3. The INDC will include a maximum of 15 members, each selected from a Member State which maintains a major nuclear data programme, which provides particular technical expertise, or which offers a needed regional perspective.

4. Each member of the Committee will be a senior expert in the field of nuclear data having broad responsibilities for the direction of nuclear data programmes or widely recognized for accomplishments in this field.

5. Each member of INDC will be requested to serve on the Committee in his personal capacity and will not represent his or her Government.

CHAIRMAN

6. The Chairman of INDC will be selected from Committee members, after consultations, and appointed by the Deputy Director General responsible for the subprogramme.

SECRETARIAT AND ADMINISTRATIVE SUPPORT

7. The Agency Secretariat will provide administrative support for INDC meetings. A member of the Agency's Secretariat will also serve as Scientific Secretary of the INDC, to assist the INDC in its work and to facilitate communications between the Committee and the Secretariat.

METHODS OF WORK

8. The Committee will determine its own methods of work.

9. The Committee will consider issues submitted by the Deputy Director General responsible for the subprogramme, and by its members.

10. Observers from Member States or other international organizations may be invited by the Deputy Director General responsible for the subprogramme to attend INDC meetings, or particular sessions during such meetings.

11. The Deputy Director General responsible for the subprogramme and representatives nominated by him will be entitled to participate in the meetings of INDC.

12. The INDC will record its recommendations in a biennial report submitted to the Deputy Director General responsible for the subprogramme.

MEETINGS

13. The INDC will meet, normally in Vienna, at intervals of at least once every 2 years, with each meeting lasting up to 5 working days. Meetings will be conducted in English.

14. Members may be accompanied to INDC meetings by advisors.

15. All travel costs associated with the participation in INDC meetings of members, advisors and observers are expected to be borne by the respective sponsoring organizations. However, where possible, support will be provided by the Agency for the participation of members from developing Member States.

Appendix 7

Work Programme Proposals

Proposals for new IAEA CRPs/DDPs, and 2005 ICTP Workshops

Proposals for new Co-ordinated Research Projects (CRP)
within the programme and budget 2005/06-2007

Title of CRP	**Development of a Reference Database for Ion Beam Analysis**
Project title	Nuclear data for ion beam analysis
Problem to be addressed	Available cross section data required for ion beam analysis (IBA) [non-Rutherford elastic scattering and nuclear reactions] are unsatisfactory. Existing compilations are incomplete, consist of unevaluated data, and show numerous discrepancies.
Specific objectives	Create a nuclear cross section database for IBA that contains reliable and usable data that will be made available freely to the user community.
Relevance to project objectives	CRP will contribute to the project objective of making suitable good-quality data available by means of the following steps: (1) identification of the most important reactions for IBA, (2) search of literature and electronic databases, and conversion of relevant data to the format used in IBA simulation programs, (3) comparison of data from different sources and measurement where there are no data or unresolved discrepancies, (4) application of model calculations to interpolate and/or evaluate cross sections, (5) incorporation of all measured and evaluated data into the database and making them available to the IBA community.
Nuclear component	Resulting database can be used in many applications such as analysis of thin films, surface and interface engineering, fundamental art and archeological studies, environmental studies, and nuclear waste storage.
Relationship to previous and on-going CRPs	Similar procedures, methodologies and formats to previous CRPs dedicated to nuclear reaction cross sections (e.g., CRP on Charged-particle cross section database for medical radioisotope production / Diagnostic radioisotopes and monitor reactions, or CRP on Light element cross section standards).
Originator of the proposal	CRP proposal stems from: - AGM on Long-Term Needs for Nuclear Data (November 2000), - TM on Database of Evaluated Cross Sections for IBA (October 2003).
Duration	2005 - 2008.

Proposals for new Co-ordinated Research Projects (CRP)
within the programme and budget 2006-2007

Title of CRP	**Minor Actinide Neutron Reaction Data for Closed Fuel Cycle Reactor Concepts**
Project title	Evaluated nuclear data for closed fuel cycle reactor concepts
Problem to be addressed	Innovative reactor concepts with high burnup and continuous recycling of heavy actinides require more accurate data for the minor actinides, for which fewer measurements are available because they are not important in conventional reactor designs. Assessment of available experimental information in combination with modern statistical data evaluation methods and advanced nuclear model codes allow the preparation of more accurate evaluations for this class of materials.
Specific objectives	Produce evaluated nuclear data files of the heavy minor actinides with particular emphasis on Am and Cm isotopes.
Relevance to project objectives	Output of the CRP will provide more accurate data that are needed in the design studies of innovative reactor concepts.
Nuclear component	Project directly addresses the needs for data in a number of nuclear applications.
Relationship to previous and on-going CRPs	CRP on "Evaluated nuclear data for Th-U fuel cycle" addressed the lighter minor actinides; the presently proposed addresses the heavier minor actinides.
Originator of the proposal	CRP proposal stems from: - anticipated needs of INPRO activities, and the impact of the 4th Generation Reactor Project in the USA, - review by the INDC (May 2002).
Duration	2007 - 2011.

Proposals for new Co-ordinated Research Projects (CRP)
within the programme and budget 2006-2007

Title of CRP	**Evaluated Nuclear Data Files of Charged-Particle Interactions for Medical Therapy Applications**
Project title	Nuclear data for radiotherapy using radioisotopes and external radiation sources
Problem to be addressed	Provide evaluated nuclear data files describing charged-particle interactions with materials relevant to medical applications, from beam generation and collimation to the interaction of the beams with patients' tissues and dosimetric materials.
Specific objectives	1) Compile nuclear model parameters for charged-particle reactions: this exercise is related to the existing RIPL-III CRP. 2) Evaluate resonance parameters for charged-particle interactions. 3) Upgrade and verify nuclear model codes such as EMPIRE-II for generating charged-particle interaction data, and prepare evaluated nuclear data files for the most important materials. 4) Validate data by analysing a suitable benchmark experiment.
Relevance to project objectives	Output of the CRP will provide more accurate data that are needed in radiation treatment planning and dosimetry, particularly in the emerging techniques using ion beams.
Nuclear component	The project directly involves the preparation of nuclear data for application of nuclear techniques in medicine.
Relationship to previous and on-going CRPs	The CRP would add to the RIPL database and the on-going CRP on the "Validation of RIPL and its implementation in modern nuclear model codes".
Originator of the proposal	CRP proposal stems from lack of data and expressed need for them from NAHU.
Duration	2007 - 2011.

Maintenance of Neutron Cross-Section Standards

Proposal for Data Development Project

A. Carlson, NIST and D. Smith, ANL
March 16, 2004

Neutron cross-section standards are of critical importance to all the evaluation projects for producing new and improved versions of their libraries. It is important to have standards available that are current. In some cases the time interval between new evaluations of the standards is quite large. For example the ENDF/B-VI standards were completed in 1987. It is anticipated that the standards for the ENDF/B-VII library will be completed in 2005.

A mechanism for updating the standards so they will be available, as each evaluation project needs them, should be established. Due to the international nature of such an endeavour, it seems appropriate for the IAEA to continue in such an activity as it did in the CRP on the international evaluation of the neutron cross-section standards conducted in 2001-2005. The file maintained by the Project would be called "The International Neutron Cross-Section Standards File" and would have a release date and version to remove confusion as to the standards being used in a given library.

The success of that CRP suggests that a follow-up IAEA activity be established to maintain the database and evaluation techniques for the neutron cross-section standards. Much time and effort was spent organizing the CRP for the standards evaluation. Not all the codes used for the last standards evaluation (for ENDF/B-VI) were available for use in the evaluation being done by the IAEA CRP. If a mechanism is not established for updating the standards on a continuing basis, it may be very difficult to initiate a new standards evaluation when it is needed in the future.

By maintaining a follow-up activity, a mechanism will be available for storing, testing and improving the codes, and their documentation, used for new standards evaluations. Appropriate international experts will work in the Project who know how to use the individual codes. Also such a project can monitor standards experimental activity, suggest experiments that are needed to resolve discrepancies, critique experiments and add them to the database. In this manner, a well documented database relevant to neutron cross-section standards should be possible. Such an effort would only require a fraction of a man-year per year from a staff member of the IAEA NDS, and funds to conduct a small technical meeting of international experts once per 2 years.

Photon-source Database for Commercial Accelerators Used in Medical Radiotherapy Applications

Proposal for Data Development Project (joint with IAEA-NAHU)
Proposer: A. Trkov (IAEA-NDS)
April 2004

Background

Commercial electron accelerators are widely used in hospitals nowadays for the treatment of patients. A lot of work is being undertaken on the physical and clinical dosimetry required for quality assurance and control of radiotherapy treatments. The Monte-Carlo method has become "a gold standard" in the physical and clinical dosimetry of linear accelerator beams. Recently, the Monte-Carlo approach was demonstrated to be capable of calculating ion chamber responses at the 0.1% level of accuracy, at least with respect to the input cross sections. Significant progress has been achieved in the development of the advanced electron transport algorithm, which is frequently used in medical physics.
Thus, the best way to address dosimetry problems is by using the Monte-Carlo method to carry out detailed simulations of the dose measurements. However, the accuracy of the calculations depends on the accuracy with which the photon source is known. Physical properties of the source are governed by the construction details of the accelerator target, but this is proprietary information that manufacturers are reluctant to release. It would be easier to negotiate the release of such information to a small group of experts, who would use advanced tools to prepare the relevant database of photon-source characteristics of the major suppliers of medical accelerators. The database could also benefit from the contributions of other expert groups working in the field of Monte-Carlo simulation. The database could be freely distributed to medical therapists and dosimetry research teams in Member States.

Objectives

Provide photon-source database for accelerators used in medical radiotherapy.

Scope

The project would be carried out jointly with IAEA-NAHU (Division of Human Health). NDS would provide the following services:

1) Host information in the NDS database.
2) Advertise the database in the Nuclear Data Newsletter.
3) Maintain and disseminate information through a dedicated web page on NDS server.
4) Disseminate the information on CD-ROM or other media, as requested.

Duration

The project could be initiated as a Data Development Project starting in 2006. NDS contribution would be mainly staff effort.

Proposal for
2005 ICTP-IAEA Scientific and Technical Meeting
to be funded by ICTP

Title of the meeting: Nuclear Data for Activation Analysis

Background information on the subject of the workshop
Activation analysis is a nuclear technique with a broad range of applications due to its high sensitivity and the multi-elemental nature of the results. The major strength of the technique is that the concentrations of a whole range of elements (even when present in small amounts) can be determined in a single measurement of a sample. The technique relies on the changes that occur in a nucleus after interacting with incident particles. These changes are characterized by the emission of radiation, which carry the "signature" of the element. Correct interpretation of the data requires good knowledge of the reaction mechanisms, particle transport and accurate knowledge of the nuclear constants that describe them.

Purpose of the workshop
The proposed Workshop will introduce participants to the specific features of activation analysis, present the current status of the nuclear data for different variants of the technique, identify open issues and lay the foundations for possible activities carried out under the auspices of the Agency to remedy the deficiencies.

Topics to be covered by the workshop
- Review of variants of the Activation Analysis method with respect to the probing particles (neutrons, charged particles, photons), incident particle energy (e.g., cold, thermal, epithermal, or fast neutrons) and the nature of emitted radiation (e.g., prompt or delayed photons).
- Methods and software for absolute detector calibration.
- Software for the analysis of the evaluated gamma spectra (with exercises).
- Nuclear constants for activation analysis (PGAA, k_0 method) and their relation to differential cross-section data (definitions and data consistency).

Links to the Agency's Programme and to its expected outcomes
The proposed workshop is linked to the following Agency projects:
- CRP on "Development of Database for Prompt Gamma-ray Neutron Activation Analysis" (1999-2003), Nuclear Data Section.
- CRP on Development of a Generalised Nuclear Constants for Activation Analysis (planned to start in 2005), Nuclear Data Section.
- New applications of prompt gamma neutron activation analysis (PGNAA) (2002 – 2006), Industrial Applications & Chemistry Section.

The expected outcomes are:
- Training of the participants on various Activation Analysis techniques and their relative merits and limitations.
- Review of the status of nuclear constants for Activation Analysis.

Duration:
2 weeks

Preferred Period:
March 2005

Number of expected participants:
10 lecturers and 30 participants;
Lecturers will consist of top scientists working actively on activation analysis studies. Participants are expected to come from developing (25 participants funded by ICTP) and developed (5 participants at no cost to the ICTP) countries.

Requirements
Giambiaga lecture room;
InfoLab Eklund with 25 PCs for computer exercises;
Adriatico Guest House (AGH).

Costs in Euros
Majority of funding to be borne by ICTP for 10 lecturers, 20 participants from developing countries, lecture room, computer facilities and local secretarial support:
45,000 Euro, provisional estimate
(approx. 4,000 Euro borne by IAEA for part DSA of own staff; balance from ICTP).

Names of organizers:
A. Trkov, Nuclear Data Section, Division of Physical and Chemical Sciences,
Department of Nuclear Sciences and Applications, International Atomic Energy Agency

Name of submitter:
A. Trkov, Nuclear Data Section, Division of Physical and Chemical Sciences,
Department of Nuclear Sciences and Applications, International Atomic Energy Agency

Date:
January 2004

Proposal for
2005 ICTP-IAEA Scientific and Technical Meeting
to be funded by ICTP

Title of the meeting: Nuclear Structure and Decay Data: Theory and Evaluation

Background information on the subject of the workshop

ENSDF (Evaluated Nuclear Structure Data File) represents an enormous source of nuclear data and information for basic research and applications. Maintenance and further development are vitally important, and need continuing scientific effort. Input to ENSDF from developing countries has been limited, but the time is now ripe for scientists from these countries to make a significant contribution to on-going efforts. The proposed Workshop represents the initiation of a suitable mechanism to achieve this aim by focusing on advances in nuclear structure physics, evaluation methodologies and practical training.

Purpose of the workshop

Reliable evaluated nuclear structure and decay data are of vital importance in a large number of nuclear applications such as power generation, material analysis, dosimetry and medical diagnostics, as well as basic nuclear physics and astrophysics. Important features of these needs are satisfied by the work programme of the International Nuclear Structure and Decay Data Evaluators' Network (NSDD), created in 1974 and coordinated by the IAEA Nuclear Data Section. The main products of this worldwide network are the recommended data files of ENSDF.

Heavy-ion facilities, coupled to sophisticated multi-spectrometers (particle-particle, gamma-gamma, etc.,), allow exploitation of high-spin states with complex structure and other nuclear phenomena such as super-deformation. The development of radioisotope ion-beam facilities permits the study of nuclei far from the line of stability. The Monte Carlo shell and other models can also be used to estimate nucleon-nucleon forces in lights nuclei. Thus, a large body of new nuclear structure information is emerging that needs to be properly assembled, collated, evaluated and preserved for the use and convenience of the worldwide scientific community.

Topics to be covered by the workshop

The primary objectives of the Workshop are to familiarize nuclear physicists with:

(i) modern nuclear structure models;
(ii) links to experimental data that characterise the decay properties of nuclei and their nuclear structure;
(iii) evaluation methodologies for nuclear structure and decay data;
(iv) preparation of mass chain evaluations (Evaluated Nuclear Structure Data File, ENSDF).

Participants will learn the criteria by which nuclear structure data are evaluated and how these data are entered into ENSDF. Important elements of the Workshop will be the use of computer codes to evaluate decay data and construct ENSDF. A major ancillary aim is to identify and encourage those students with greatest promise and most suitable work environment to undertake mass chain data evaluations for ENSDF and *Nuclear Data Sheets*, and so inject crucial new blood into this world-renowned and highly-respected data evaluation work.

Links to the Agency's Programme and to its expected outcomes

The International Network of Nuclear Structure and Decay Data Evaluators, Vienna (at meetings 4-7 December 2000 and 10-14 November 2003) has requested that the IAEA initiate a series of Workshops on Nuclear Structure and Decay Data at ICTP in order to provide a forum for know-how transfer, particularly to scientists in developing countries. Such highly-focused workshops were strongly endorsed as urgently required by the International Nuclear Data Committee (IAEA Vienna, 24–26 May 2000 and again 14-17 May 2002), which peer reviews the work of the IAEA Nuclear Data Section and includes representatives from both developed and developing countries.

Extremely successful pilot and full 2-week workshops were held at IAEA Vienna (18-22 Nov 2002) and ICTP Trieste (17-28 Nov 2003), respectively. Between them both of these workshops identified the existence and willingness of approximately 10 individual scientists and their co-workers to undertake such important work in the future for ENSDF – essential new blood has been discovered through this workshop process to ensure the continued preparation of high-quality mass chain data evaluations for worldwide usage. All other students benefited immensely from the resulting training with respect to their development and understanding of nuclear physics.

The proposed workshop follows on 18-24 months after the previous equivalent ICTP workshop, as requested by the INDC and Evaluators' Network. This Workshop on Nuclear Structure and Decay Data was incorporated into the IAEA programme of work for 2005 under sub-programme D.1 project 01, part of task 16 (as ICTP workshop) in order to maintain and continue the good work.

Duration: Two weeks

1st week: Nuclear Structure and Decay Data
- Nuclear structure models, and calculation of nuclear decay parameters
- Experimental techniques to measure decay data
- Evaluated nuclear structure data file (ENSDF)
- Computer exercises

2nd week: Evaluation Methods for Nuclear Structure Data
- Nuclear structure analysis codes
- Codes for data evaluation
- Data retrieval and applications
- Computer exercises

Preferred Period: Spring 2005

Number of expected participants:

10 lecturers and 30 participants;
Lecturers will consist of top scientists working actively on nuclear structure studies, including evaluators from the International Network of Nuclear Structure and Decay Data Evaluation. Participants are expected to come from developing (25 participants funded by ICTP) and developed (5 participants for no cost to the ICTP) countries.

Requirements

Giambiaga lecture room;
InfoLab Eklund with 25 PCs for computer exercises;
Adriatico Guest House (AGH).

Costs in Euros
Majority of funding to be borne by ICTP for 10 lecturers, 20 participants from developing countries, lecture room, computer facilities and local secretarial support:
45,000 Euro, provisional estimate
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Names of organizers:
A. L. Nichols (IAEA, Vienna, first week);
A. Ventura (ENEA, Bologna, Italy, second week);
J.G. Tuli (NNDC, Brookhaven National Lab., USA).

Name of submitter:
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Date: 20/01/2004