

A newsletter of the Nuclear Data Section (NDS)  
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*Dr. Adnan Shihab-Eldin, Director General, KFAS at the opening ceremony of the 20<sup>th</sup> International Network of Nuclear Structure and Decay Data Evaluators, held in Safat, Kuwait from 27 to 31 January 2013.*

## From the Section Head

In previous newsletters we have focussed on some aspects of the Section's work such as EXFOR or Atomic and Molecular data. In the current one (see next page) there are details of the work of the Nuclear Data Development Unit. A major event in the last six months has been the Nuclear Data for Science and Technology ND2013 Conference held in New York, USA. More details are given on page 8. High attendance and high quality of papers indicate the continuing interest in nuclear data worldwide. An area of current discussion is new representations of the familiar data formats established for all data files, evaluated reaction data, experimental reaction data and evaluated structure data. One possibility is the use of XML and this is being discussed in various international fora. Feedback from readers on this topic is very much welcomed.

Since the last newsletter issue there have been several staff changes due to retirement or internal changes. With the departure of Daniel Abriola back to Argentina, Roberto Capote Noy has taken on the role of Head of the Data Development Unit. Liam Costello retired late last year. This newsletter has been prepared by Lidija Vrapcjenjak who took over the position left vacant when Janet Roberts retired. For more details please see Staff Items on page 11.

Due to a major redesign of the servers and the procedures for updating over the last few months, we have been preoccupied with restoring the web services. A fuller description will appear in the next newsletter, for now the website is working with some restricted functionality but with the goal to ensure a more secure service in the future.

*Robin Forrest*

# Nuclear Data Development Unit (NDDU)

The NDDU is leading IAEA/NDS nuclear data research and development activities primarily aimed at improving the quality and quantity of nuclear data available for dissemination to all IAEA Member States, and to enhance the peaceful use of technology in fission and fusion energy technologies and non-energy applications (such as medical applications and analytical science). The Unit also organizes training workshops both at International Centre for Theoretical Physics (ICTP, Trieste, Italy), and at IAEA headquarters in Vienna. The staff includes three physicists (currently R. Capote and P. Dimitriou) and one support staff (K. Nathani). Other former colleagues of the last 10 years include D.H. Abriola, M. Kellett, A. Trkov, R. Paviotti-Corcuera, M.W. Herman, and P. Oblozinsky.

Data are produced mainly through the organization of Coordinated Research and Data Development Projects (CRPs and DDPs) and technical meetings. Additional work is also undertaken through contracts, agreements, and technical collaboration with experts in specific fields, including technical work undertaken directly by IAEA staff. Immediate outputs of the Unit's activities include the creation, verification and validation of new databases designed and dedicated to various energy and non-energy applications; updating and extending existing databases; delivering detailed technical documentation; and developing, validating and disseminating advanced software systems for nuclear reaction modelling and nuclear data evaluation. The Unit will be involved in the new international collaborative project CIELO organized by OECD.

Among recent nuclear data projects coordinated by the NDDU that achieved high visibility we may mention:

**Reaction data:** [Reference Input Parameter Library: 3 CRPs 1993-2009](#) – Nucl. Data Sheets **110** (2009) 3107;

**Energy applications:**

International Reactor Dosimetry File 2002: DDP 2001-2005 – IAEA **TRS-452** (2006);

[International Evaluation of Neutron Standards: CRP 2001-2006](#) – Nucl. Data Sheets **110** (2009) 3215;

Nuclear Data for Th-U fuel cycle: CRP 2002-2007 – IAEA **STI/PUB/1435**;

Updated decay library for actinides: CRP 2005-2010 (in press).

Prompt fission neutron spectra for actinides: CRP 2009 - 2014 (on-going);

Evaluation of neutron induced reactions on tungsten isotopes: DDP (2007-2010)

**Analytical science:**

Reference database for ion beam analysis: CRP 2005-2010 (to be published).

Reference database for neutron activation analysis: CRP 2005-2010 (to be published).

Reference database for particle induced gamma-ray emission spectroscopy: CRP 2011- (ongoing)

**Medical applications:**

Nuclear Data for the production of therapeutic radionuclides: CRP 2003-2008 – IAEA **TRS-473** (2012);

Nuclear Data for Charged-particle Monitor Reactions and Medical Isotope Production: CRP 2012- (on-going)

Another important NDDU activity is the Coordination of the International Network of Nuclear Structure and Decay Data Evaluators (NSDD). NSDD is an international team of experts who provide recommended nuclear structure and decay data to be used in basic and applied research. These data include: bibliographic information: Nuclear Science References (NSR) and evaluated numerical data: Evaluated Nuclear Structure Data File (ENSDF). The NSDD network was established in 1974 under the auspices of the International Atomic Energy Agency (IAEA), and includes 15 data centres and groups located in laboratories, institutes and universities within 17 countries. Network scientists evaluate nuclear structure and decay data for all isotopes on an agreed basis; they also compile the most recent experimental results in the Unevaluated Nuclear Data Library (XUNDL).

Meetings of the International Network of Nuclear Structure and Decay Data Evaluators (NSDD) are coordinated by the IAEA, and are held biennially. The 20<sup>th</sup> meeting took place in Kuwait in January 2013.

The IAEA also organizes jointly with the International Center for Theoretical Physics, Trieste, Italy, a workshop on Nuclear Structure and Decay Data: Theory and Evaluation in Miramare, Trieste, every second year thus providing a unique opportunity for scientists to gain extensive and up-to-date training on the evaluation of nuclear structure and decay data.

# Computer Codes and Data Libraries – News

Databases and libraries are available for download or on CD-ROM/DVD cost-free on request.  
Please find a complete list of all computer codes and data libraries available from NDS on:  
<http://www-nds.iaea.org/cd-catalog.html>.

**EXFOR** – the Experimental Nuclear Reaction Data continues to grow via systematic addition of newly published or missed old data. After the last update in March 2013, it contains around 20 000 experimental works and 150 000 data sets. The recent updates of the web retrieval system include: collection of video-guides to EXFOR-ENDF database web retrieving, searching for data compiled by digitization of plots or from tables, new plotting capabilities such as on-fly switching display between data and their ratios.

**TENDL-2012** - a nuclear data library which provides the output of the TALYS nuclear model code system for direct use in both basic physics and applications. TENDL contains evaluations for seven types of incident particles, for all isotopes living longer than 1 second (about 2400 isotopes), up to 200 MeV, with covariances. The 5<sup>th</sup> version is TENDL-2012, which is based on both default and adjusted TALYS calculations and data from other sources, was released in January 2013.

**ENSDF and XUNDL** – the Evaluated and Experimental Unevaluated Nuclear Structure Data File Database. The ENSDF database contains evaluated nuclear structure and decay information for over 2 900 nuclides. The file is

**LiveChart** – the web interface to the Nuclear Structure and Decay Data. The last update includes new decay radiation data; plotting capabilities such as decay schema (Fig. 1), beta and bremsstrahlung spectra (Fig. 2) as well as a web page where all Mass Chains are presented (Fig. 3). The web technology was changed from Java applet to HTML. The LiveChart is available at <http://www-nds.iaea.org/livechart>

updated on a continuous basis. New evaluations are published in Nuclear Data Sheets. The XUNDL database contains experimental data compiled from over 2 500 recent nuclear structure papers. Last update was done in March 2012.

**PREPRO-2012** - the ENDF/B pre-processing code is a collection of 17 parts, which are designed to convert ENDF/B formatted neutron and/or photon data from the original distributed form to a form in which the data can be used in applications. Last updates made in October 2012 allow processing of the current ENDF/B formatted libraries, such as ENDF/B-VII.1.

**IBANDL** - the collection of experimental and calculated charged-particles induced nuclear reaction cross sections suitable for Ion Beam Analysis. The web interface access to this database was redesigned and became available online in April 2013. It now provides a summary of data collected for specific types of reactions with references; includes links to the same datasets in EXFOR; converts reaction cross sections to Rutherford ratio and back; uses advanced Web-ZVView interface for interactive plotting and retrieval of numerical data.

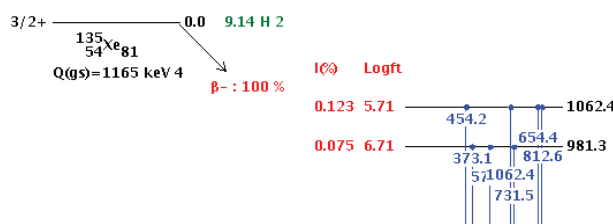


Fig. 1 Decay plotting example

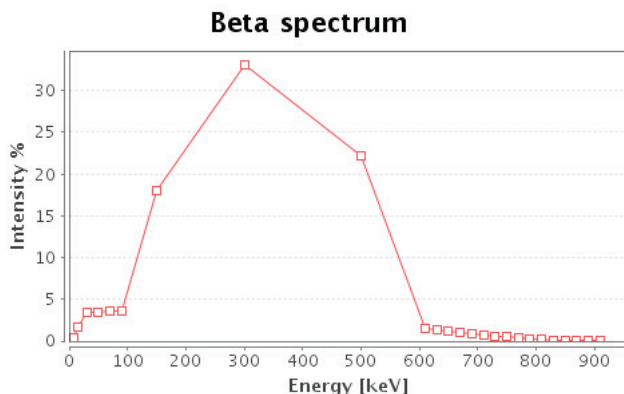


Fig. 2 Beta spectrum example



Fig. 3 Mass chain example



# NDS Meeting Reports

Meeting reports, when finalised, available at <http://www-nds.iaea.org/publications/>

## Joint IAEA-ICTP Workshop on Nuclear Structure and Decay Data: Theory and Evaluation Trieste, Italy, 6-17 August, 2012

Directors: D. Abriola (IAEA) and J.K. Tuli (NNDC, BNL); Local Organizer: C. Tuniz, 22 participants



*Participants of the Joint IAEA-ICTP Workshop on Nuclear Structure and Decay Data: Theory and Evaluation.*

The 6<sup>th</sup> in a series of workshops was held for a period of two weeks. About 22 trainees from various countries attended the workshop. All lecturers, apart from Piet Van Isacker of GANIL, France, were NSDD evaluators from the USA, Canada, and the IAEA. Besides regular lectures in the morning there were hands-on practical sessions in the afternoon. The trainees were divided into six groups,

each under the leadership of one or more experienced evaluators. The evaluation of mass chain  $A=211$  was undertaken collectively by the six groups, under over-all coordination of Balraj Singh of McMaster University, Canada. Details of the workshop can be accessed at: [http://cdsagenda5.ictp.it/full\\_display.php?email=0&ida=a11181](http://cdsagenda5.ictp.it/full_display.php?email=0&ida=a11181).

## 1<sup>st</sup> Research Coordination Meeting (RCM) on Erosion and Tritium Retention for Beryllium Plasma Facing Materials Vienna, Austria, 26-28 September, 2012

Scientific Secretary: B. Braams, 9 participants and IAEA staff.



*Participants of the 1<sup>st</sup> RCM on Erosion and Tritium Retention for Beryllium Plasma Facing Materials.*

This new CRP was initiated because of the very active interest in the properties of beryllium as a wall material in fusion devices. The intended plasma-facing materials in ITER are beryllium and tungsten: beryllium for most of the vacuum vessel and tungsten for the regions of highest heat load. Since August 2011 the Joint European Torus (JET) experiment operates with an “ITER-Like” Be-W vacuum vessel wall. Beryllium has in its favour

good heat conductivity and strong gettering capability, tolerance as a plasma impurity and low nuclear activation. On the other hand, beryllium is more subject to melting and erosion than other possible wall materials, and tritium retention in beryllium is also a concern. The CRP brings together modellers and experimentalists and it has the objective to improve the database on plasma-wall interaction processes with beryllium.

## Technical Meeting (TM) on Primary Radiation Damage Vienna, Austria, 1-4 October, 2012

Scientific Secretary: S. Simakov; Chairman: R.E. Stoller; Rapporteur: K. Nordlund  
16 participants and IAEA staff



*Participants of TM on Primary Radiation Damage.*

The meeting was convened to bring together experts from both the nuclear data and materials research communities because of their common objective of accurately characterizing irradiation environments and resulting material damage. The meeting demonstrated that significant uncertainties remain regarding both the status of nuclear data and the use of these data by the materials modelling

community to determine the primary damage state found in irradiated materials. The participants agreed that there is clear motivation to initiate a CRP that engages participants from both the nuclear data and materials research communities. The meeting report is available from <http://www-nds.iaea.org/publications/indc/indc-nds-0624.pdf>

## 2<sup>nd</sup> Research Coordination Meeting (RCM) on Reference Database of Cross Sections for Particle-Induced Gamma-ray Emission (PIGE) Vienna, Austria, 8-12 October, 2012

Scientific Secretary: D. Abriola; Chairman: A. Gurbich; Rapporteur: A. Pedro de Jesus, 12 participants and IAEA staff

Participants presented the work that has been done so far, and certain aspects of the methodology adopted in the first RCM were revisited, such as accelerator calibration, target preparation and  $\gamma$ -ray detector efficiency calibration. Each participant assumed the responsibility for coordinating a set of measurements on a particular nuclide, and also for reviewing the scientific literature in search of previous data, and assessing the data before submitting

them for inclusion in IBANDL. The preliminary versions of the computer codes that would allow the final user to profit from the PIGE database were presented and the feasibility of performing evaluations and theoretical calculations was highlighted. The report is already available from the NDS webpage:

<http://www-nds.iaea.org/publications/indc/indc-nds-0625/>

## Consultants Meeting (CM) on Benchmarking of Digitizing Software Vienna, Austria, 12-14 November, 2012

Scientific Secretary: V. Semkova, Chairman: L. Bawitlung; Rapporteur: N. Otsuka; 12 participants and IAEA staff



*Participants of CM on Benchmarking of Digitizing Software.*

The meeting brought together software developers and compilers to discuss the current status and the future software developments, the quality assurance of the digitized data in EXFOR; the format of the numeric data presentation; methods for assessment of the digitization uncertainties, etc. A benchmark exercise was organised within the International Network of the Nuclear Reaction Data Centres (NRDC) prior to the meeting. The results were presented and discussed during the meeting. Some

advanced features such as: automatic image recognition, techniques for digitization of distorted images, and tools for independent validation of the results from digitization were particularly endorsed. For meetings details please visit <http://www-nds.iaea.org/digitization/>. A summary report INDC(NDS)-0629 is available at <http://www-nds.iaea.org/publications/indc/indc-nds-0629.pdf>.

### **1<sup>st</sup> Research Coordination Meeting (RCM) on Nuclear Data for Charged-particle Monitor Reactions and Medical Isotope Production Vienna, Austria, 3-7 December, 2012**

Scientific Secretary: R. Capote Noy, Chairman: F. Tarkányi; Rapporteur: A.L. Nichols, 13 participants and IAEA staff



*Participants of the 1<sup>st</sup> RCM on Nuclear Data for Charged-particle Monitor Reactions and Medical Isotope Production.*

The 1<sup>st</sup> RCM was convened to coordinate joint activities, and define a detailed program of work of the CRP for the next two years. Participants re-assessed and reviewed the requirements for both cross section and decay data for charged-particle monitor reactions and medical isotope production using accelerators. Recommendations focused on cross section studies for a reasonably wide range of

targets and projectiles, along with decay data measurements and evaluations for specific radionuclides. Individual presentations and discussions are described in the Summary report [INDC\(NDS\)-0630](#), along with listings of the agreed work packages to be undertaken by the participants of the coordinated research project.

### **20<sup>th</sup> Meeting of The International Network of Nuclear Structure and Decay Data (NSDD) Evaluators Safat, Kuwait, 27-31 January, 2013**

Scientific Secretary: D. Abriola and P. Dimitriou, Chairman: J. Tuli; Rapporteur: E.A. McCutchan  
36 participants from 17 countries  
(hosted by the Kuwait Foundation for the Advancement of Sciences (KFAS), Safat, Kuwait)



*Participants of the 20<sup>th</sup> Meeting of NSDD Network.*



The meeting was attended by 36 scientists from 17 Member States, and IAEA staff, concerned with the compilation, evaluation and dissemination of nuclear structure and decay data. The support and generous hospitality of the hosts KFAS and Kuwait University are gratefully acknowledged. During the meeting steps were suggested to assure the quality and completeness of the ENSDF database. With this in mind, a detailed list of actions was produced, covering the time up to the next Network

meeting of NSDD evaluators. Technical improvements to facilitate the work of evaluators were discussed, including upgrading and modernizing utility and analysis codes. The need to provide evaluators with continuous training through specialized training or re-fresher workshops was recognized as important. The 21<sup>st</sup> Meeting of the International Network of Nuclear Structure and Decay Data Evaluators will be held in 2015 at the IAEA Headquarters in Vienna.

### **Consultants' Meeting (CM) on Accuracy of Experimental and Theoretical Nuclear Cross Section Data for Ion Beam Analysis and Benchmarking Vienna, Austria, 11-13 March, 2013**

Scientific Secretary: D. Abriola and P. Dimitriou, Chairman: Mayer; Rapporteur: A. Gurbich  
5 participants and IAEA staff



*Participants of CM on Accuracy of Experimental and Theoretical Nuclear Cross-Section Data for Ion Beam Analysis and Benchmarking.*

The purpose of this Consultants Meeting was to provide a general review of the status of the scientific activity in Ion Beam Analysis (IBA), to review possible ways to resolve the problem of assigning uncertainties to IBA relevant differential cross section data and to determine

whether a CRP is a proper instrument to achieve this goal. The participants recognized that the complexity of the problem requires a thorough preparation of the guidelines, program, and methodology of the work. Meeting report is in preparation.

### **3<sup>rd</sup> Research Coordination Meeting (RCM) on Light Element Atom, Molecule and Radical Behaviour in the Divertor and Edge Plasma Region Vienna, Austria, 20-22 March, 2013**

Scientific Secretary: B. Braams, 17 participants and IAEA staff



*Participants of the 3<sup>rd</sup> RCM on Light Element Atom, Molecule and Radical Behaviour in the Divertor and Edge Plasma Region.*

This was the third and final Research Coordination Meeting of the CRP. All light elements (H – O) are of interest for fusion experiments: hydrogen as the main plasma constituent, helium as the product of fusion, lithium and boron as wall coating materials, beryllium and carbon as primary wall materials, nitrogen as a deliberately introduced radiating gas and oxygen as a ubiquitous impurity.

The CRP is focused on the database for collision processes involving mainly the hydrides of these light element impurities. The meeting had 17 external participants representing 14 research projects in the area of experimental and computational atomic physics. The data produced in the course of the CRP are important for plasma modelling and plasma diagnostics.

## International Conference on Nuclear Data for Science and Technology (ND2013) New York, USA, 4-8 March, 2013

One of the most important conferences in the nuclear data field (“ND Conference”) preceding conferences in Harwell (1978), Antwerp (1982), Santa Fe (1985), Mito (1988), Jülich (1991), Gatlinburg (1994), Trieste (1997), Tsukuba (2001), Santa Fe (2004), Nice (2007) and Jeju (2010) was organized by the National Nuclear Data Center at Brookhaven National Laboratory (BNL) in collaboration with the IAEA, OECD NEA and other co-sponsors. The conference was attended by 435 participants and benefited from the sponsorship of the IAEA and LANL. The conference was opened by M. Chadwick (LANL) following the welcome addresses by M. Herman and A. Sonzogni (BNL). There were in total 350 talks and 120 posters including 8 plenary talks. Three NDS staff represented the IAEA, and gave presentations on

data evaluation, formats as well as compilation. Many other presentations were co-authored by the NDS staff. In the presentations IAEA projects on nuclear data and evaluated data produced within IAEA were referred to positively.

In addition to sessions covering the core activities of nuclear data (e.g., cross section measurements, nuclear reaction models), there were some sessions reflecting new trends - nuclear reactor antineutrinos, determination of the mixing angle  $\theta_{13}$  by detection of reactor neutrinos, and nuclear physics education. The conference proceedings will be published in Nuclear Data Sheets. The next conference in this series, ND2016, is anticipated to be organized by EC-JRC IRMM in Brugge, Belgium in 2016.

## Technical Meeting (TM) of the International Network of Nuclear Reaction Data Centres Vienna, Austria, 23-25 April 2013

Scientific Secretary: N. Otsuka, Chairman: O. Schwerer, 16 participants and IAEA staff



*Participants of the TM of the International Network of Nuclear Reaction Data Centres.*

Thirteen cooperating data centres from China, Hungary, India, Japan, the Republic of Korea, Russian Federation, Ukraine, USA, OECD NEA and IAEA were represented at the meeting. Main topics of the present meeting were EXFOR transmission statistics, EXFOR coverage and quality control, revision of coding rules and manuals, EXFOR/CINDA dictionaries as well as improved tools for compilation and dissemination. A total of 36 working papers were presented, and the results of the discussions were summarized as 22 conclusions and 75 actions.

Several recommendations from the 28<sup>th</sup> (2010) and 29<sup>th</sup> (2012) International Nuclear Data Committee (INDC) Meetings were intensively discussed. The participants concluded that EXFOR entries should not be created for preliminary data published in conference proceedings within certain period if authors are reluctant to provide numerical data. The participants were also reminded that (1) duplication of the same experimental data set in EX-

FOR entries must be avoided; (2) mistakes in EXFOR entries must be corrected in a timely manner.

EXFOR is regarded as “complete” for low-energy neutron-induced reaction data. However we still often find experimental (mainly charged-particle induced reaction) data missing in EXFOR even if we limit the scope of compilation to the light ( $A \leq 12$ ) projectiles at low and intermediate ( $E \leq 1$  GeV) energies. Also there are many existing EXFOR entries which must be upgraded because the EXFOR format has been upgraded to cover more quantities and also data digitization is now a standard procedure to include numerical data to EXFOR entries. In the relation with IAEA CRPs and other projects, NRDC is regularly performing completeness and quality checking from various aspects, and trying to improve the contents of EXFOR.

A summary report of the meeting will be published as INDC(NDS)-0633.



## Forthcoming Events

### **ICTP/IAEA Workshop on Nuclear Data for Science and Technology: Medical Applications, 30 September – 4 October 2013, Trieste, Italy**

The Workshop will continue a series of ICTP Workshops covering data for medical applications initiated in 1999 and continued in 2007. Many new medical applications of nuclear techniques have been developed over the late 20th century, and these applications have introduced new requirements for atomic and nuclear data, including both decay information and cross-section data. Efficient and safe application of these techniques requires appropriately trained and dedicated medical physicists. The deadline for registration is **15 June 2013**.

For more details please visit the ICTP webpage: [http://cdsagenda5.ictp.it/full\\_display.php?email=0&ida=a12207](http://cdsagenda5.ictp.it/full_display.php?email=0&ida=a12207)

### **ICTP/IAEA Workshop on Nuclear Data for Analytical Applications, 21-26 October 2013, Trieste, Italy**

The workshop will continue the series of “Nuclear Data for Science and Technology” workshops initiated in 1999, and held at regular intervals since then. Topics to be covered include nuclear data and on-line retrieval systems; fundamentals of energetic particle interaction with matter, atoms and nuclei; overview of IBA techniques (RBS, ERDA, EBS, NRA, PIGE); nuclear data for IBA – IBANDL data library; nuclear data for Particle Induced Gamma Ray Emission (PIGE); applications of IBA and PIGE in particular. The deadline for requesting participation is **25 May 2013** ([http://cdsagenda5.ictp.it/full\\_display.php?email=0&ida=a12218](http://cdsagenda5.ictp.it/full_display.php?email=0&ida=a12218))

### **Technical Meeting “Toward a New Evaluation of Neutron Standards”, 8-12 July 2013, IAEA, Vienna**

The international Neutron Standard group will define needed steps and agree a work-plan and schedule towards producing a new Neutron Standard evaluation. The new evaluation will update and extend the current IAEA Neutron Standards released in 2006.

### **IAEA EMPIRE Workshop “Modelling and Evaluating Nuclear Reaction Data for Energy and Non-energy Applications”, 2-6 December 2013, Lecturers: M.W. Herman, R. Capote, M. Sin, A. Trkov, and B.V. Carlson**

The Workshop constitutes an opportunity for nuclear scientists to gain extensive and up-to-date training on the use and understanding of the EMPIRE code (see <http://www-nds.iaea.org/empire>) for nuclear reaction modelling and nuclear data evaluations. Both neutron and charged-particle induced reactions will be covered addressing data needs for energy and non-energy applications.

For information please refer to: <http://www-naweb.iaea.org/napc/nd/meetings/empire.html>

Required background for participation: University degree in Nuclear Physics or Nuclear Engineering. Experience in calculations with nuclear modelling codes is highly desirable. In order to apply please send an email with your summary CV to [k.nathani@iaea.org](mailto:k.nathani@iaea.org). Application deadline is **31 August 2013**.

## Coordinated Research Projects

IAEA Coordinated Research Projects (CRPs) are a valuable mechanism for stimulating research in IAEA Member States of relevance to the IAEA programmes. Details of the CRPs of the Nuclear Data Section, both active and recently completed, can be found at: <http://www-naweb.iaea.org/napc/nd/crps.asp>.

### **New CRPs:**

**Testing and Improving the IAEA International Dosimetry Library for Fission and Fusion (IRDF):** the overall CRP objective is a validation of the recently released IRDF library. It is an extension of IRDF-2002 to cover fission, fusion and accelerator driven applications. The version 1.0 of IRDF includes 4 new reactions, 32

updated evaluations and increases the end-point energy from 20 to 60 MeV. The energy extrapolation has been made in a formal way by using the TENDL-2010 cross sections (and covariance matrices) after matching to the IRDF-2002 cross section values at the extension point. The CRP will strive to stimulate new energy integrated (integral) and point energy (differential) cross section measurements and collect all other experimental information suitable for validation but which has not been used before. The project is due to start in 2013 and is envisioned to have a length of four years (<http://www-nds.iaea.org/IRDFtest/>).

**Primary Radiation Damage Cross Sections:** the overall CRP objective is to bring together experts from nuclear

data and radiation materials to improve nuclear data responsible for nuclear induced damages (recoil spectra, dpa cross section and gas production) and find ways to overcome drawbacks of the NRT dpa standard employing the recent developments in primary radiation damage simulations. The CRP will try to determine the optimal possible parameters for correlating damage from irradiation facilities with different particle types and energy spectra, such as fission and fusion reactors, charged particle and spallation accelerators. The project is due to start in 2013 and is envisioned to have a length of four years (<http://www-nds.iaea.org/CRPdpa/>).

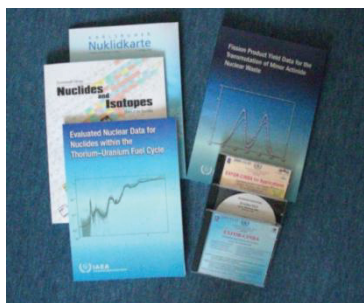
**Reference Database for Beta-Delayed Neutron Emission Data:** The overall objective of this CRP is to enhance Member States' (MS) knowledge and calculational capabilities in the fields of nuclear energy, safeguards, used fuel and waste management and nuclear sciences by creating a Reference Database for Beta-Delayed Neutron Emission that contains both a compilation of existing data and recommended data, which will be made readily available to the user community. More information about the CRP is available at <http://www-nds.iaea.org/beta-delayed-neutron/>.

Technical reports detailing the outcome of IAEA-CRPs can be accessed electronically on: <http://www-pub.iaea.org/MTCD/publications/>

## Selected Charts, Reports and Documents

All INDC series reports are available online:

[http://www-nds.iaea.org/publications/indc\\_groups.php](http://www-nds.iaea.org/publications/indc_groups.php)



### Recent Releases:

**INDC(NDS)-0576** IRDF-2002.1 Corrections to the IRDF-2002 Dosimetry Cross-Section Library (Covariance Processing Verification), prepared by M.A. Kellett, A. Trkov, October 2012.

**INDC(NDS)-0607** Summary Report of the Third Research Coordination Meeting on Characterization of Size, Composition and Origins of Dust in Fusion Devices, Vienna, 30 November – 2 December 2011, prepared by B.J. Braams, February 2013.

**INDC(NDS)-0609** Summary Report of an IAEA Technical Meeting on Improving the Database for Physical and Chemical Sputtering, Vienna, 12-13 December 2011, prepared by B.J. Braams, February 2013.

**INDC(NDS)-0624** Summary Report of an IAEA Technical Meeting on Primary Radiation Damage: From Nuclear Reaction to Point Effects, 1-4 October 2012, prepared by R.E. Stoller, K. Nordlund and S.P. Simakov, November 2012.

**INDC(NDS)-0625** Summary Report of the Second Research Coordination Meeting on Development of a Ref-

erence Database for Particle-Induced Gamma ray Emission (PIGE) Spectroscopy, 8-12 October 2012, prepared by D. Abriola, P. Dimitriou, A. Pedro de Jesus, March 2013.

**INDC(NDS)-0626** Update of RIPL Discrete Levels, prepared by T. Belgya, November 2012.

**INDC(NDS)-0628** Summary Description of the FENDL-3 Library, prepared by R.A. Forrest, R. Capote, N. Otsuka, T. Kawano, A.J. Koning, S. Kunieda, J-Ch. Sublet and Y. Watanabe, December 2012.

**INDC(NDS)-0629** Summary Report of an IAEA Consultants Meeting on Benchmarking of Digitization Software, 12-14 November 2012, prepared by N. Otsuka and V. Semkova, January 2013.

**INDC(NDS)-0630** Summary Report of First Research Coordination Meeting on Nuclear Data for Charged-particle Monitor Reactions and Medical Isotope Production, 3-7 December 2012, prepared by A.L. Nichols and R. Capote Noy, February 2013.

**Nuclear Data Sheets Special Issue on Nuclear Reaction Data, Vol. 113, No.12 (2012).** Editor: P. Oblozinsky, Assistant Editor: B. Pritychenko. Containing seven papers covering the nuclear reaction code TALYS and its innovative implementation in nuclear reaction data evaluation with Monte Carlo techniques, benchmarking of the ENDF/B-VII.1 library, experimental nuclear reaction data covariances, and evaluation of ENDF/B-VII.1 covariances in the neutron resonance region, integral quantities in neutron reactions in major evaluated nuclear data libraries, and the development of modern formats for evaluated nuclear reaction data files.

Limited hard copies available on request.

**Also Available:**

**Chart of the Nuclides 2010** JAEA Nuclear Data Centre.

**Chart of the Nuclides** (Wall chart) prepared by Knolls Atomic Power Laboratory (KAPL) and distributed by Lockheed Martin (17<sup>th</sup> edition, revised 2009). Available cost-free on request only for **teachers and scientists from developing countries**.

**Chart of the Nuclides** (Book) prepared by Knolls Atomic Power Laboratory (KAPL) and distributed by Lockheed

Martin (17<sup>th</sup> edition, revised 2009). Available cost-free on request only for **teachers and scientists from developing countries**.

**Karlsruher Nuklidkarte** Wall chart of the nuclides, 7<sup>th</sup> edition (2006). Available cost-free on request only for **teachers and scientists from developing countries**.

**Karlsruher Nuklidkarte** Desk chart of the Nuclides, 7<sup>th</sup> edition (2006). Available cost-free on request only for **teachers and scientists from developing countries**.

**Highlighted Article**

*Experimental Nuclear Reaction Data Uncertainties: Basic Concepts and Documentation*, by D.L. Smith, N. Otuka, *Nuclear Data Sheets* **113**, No. 12, pp. 3006-3053 (2012): This paper has been written to provide experimental nuclear data researchers and data compilers with practical guidance on dealing with experimental nuclear reaction data uncertainties. It outlines some of the properties of random variables as well as principles of data uncertainty estimation, and illustrates them by means of simple examples which are relevant to the field of nuclear data. Emphasis is placed on the importance of generating mathematical models (or algorithms) that can adequately represent individual experiments for the purpose of estimating uncertainties in their results. Contemporary formats used to compile reported experimental covariance data in the widely used library EXFOR are discussed, and several samples of EXFOR files are presented to demonstrate their use.



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## Staff Items

for all NDS staff details: <http://www-naweb.iaea.org/napc/nd/aboutus.asp>

After more than six years as the Deputy Section Head and the Head of the



Data Development Unit, **Daniel Abriola** retired at the end of March this year. His experience and expertise in nuclear structure and decay data

(mass chain evaluation) and efforts with IBANDL database are of great value to the whole nuclear data community. We hope that scientific bonds will remain.

**Janet Roberts** also retired in January this year. For many years she was the main support for the Section Heads and since 2010 she was taking care of the nuclear data libraries and databases collection. Her humor and dedication will be greatly missed.



**Liam Costello** retired at the end of 2012. He was taking care of all the Section's servers, and our websites. In the times of constantly changing demands in the IT world, his knowledge was very much appreciated.

We wish them all the very best for the new phase in their lives

**This newsletter, as well as previous issues, can be accessed electronically at:**  
[http://www-pub.iaea.org/books/IAEABooks/View\\_Newsletters/60/Nuclear-Data-Newsletter](http://www-pub.iaea.org/books/IAEABooks/View_Newsletters/60/Nuclear-Data-Newsletter)



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## Nuclear Data Services – Contact Points

### For services to customers in USA and Canada:

US National Nuclear Data Center, Bldg. 197D, Brookhaven National Laboratory, P.O. Box 5000,  
Upton, NY 11973-5000, USA.  
Tel. +1 631-344-2902; Fax +1 631-344-2806; Email: [nndc@bnl.gov](mailto:nndc@bnl.gov); Worldwide Web: <http://www.nndc.bnl.gov/>  
For information regarding on-line services, contact: B. Pritychenko: [pritychenko@bnl.gov](mailto:pritychenko@bnl.gov)  
For information regarding general NNDC services, contact: M. Blennau: [blennau@bnl.gov](mailto:blennau@bnl.gov)

### For services to customers in OECD/NEA Data Bank member countries:

NEA Data Bank, OECD Nuclear Energy Agency, Le Seine Saint-Germain, 12 blvd des Iles,  
F-92130 Issy-les-Moulineaux, France.  
Tel. +33 1 4524 (plus extension); Fax +33 1 45241110;  
Email: [Emmeric.Dupont@oecd.org](mailto:Emmeric.Dupont@oecd.org) or [db@nea.fr](mailto:db@nea.fr); Worldwide Web: <http://www.oecd-nea.fr/databank/> contact: E. Dupont, ext. 1084.

### For services to the customers from the former USSR:

Neutron data: Russia Nuclear Data Center, Centr Jadernykh Dannykh (CJD), Fiziko-Energeticheskij Institut, Ploshad Bondarenko,  
249020 Obninsk, Kaluga Region, Russian Federation.  
Tel. +7 08439-9-8982; Fax +7 095-230-2326;  
Email: [blokhin@ippe.ru](mailto:blokhin@ippe.ru); Worldwide Web: [www.ippe.ru/podr/cjd/](http://www.ippe.ru/podr/cjd/); contact: A.I. Blokhin.  
Charged-particle data: Russia Nuclear Structure and Reaction Data Center (CAJAD), Kurchatov Institute,  
Kurchatov Square 1, 123 182 Moscow, Russian Federation.  
Tel. +7 095-196-9968; Fax +7 095-882-5804;  
Email: [sbabykina@polyn.kiae.su](mailto:sbabykina@polyn.kiae.su); [Babykina\\_SY.@nrcki.ru](mailto:Babykina_SY.@nrcki.ru) contact: S. Babykina.  
Photonuclear data: Centre for Photonuclear Experiments Data, Centr Dannykh Fotoyadernykh Eksperimentov (CDFE),  
Skobel'syn Institute of Nuclear Physics, Lomonosov Moscow State University, Leninskie Gory, 119 922 Moscow, Russian Federation.  
Tel. +7 495-939-3483; Fax +7 495-939-0896;  
Email: [varlamov@depni.sinp.msu.ru](mailto:varlamov@depni.sinp.msu.ru) or [varlamov@depni.npi.msu.ru](mailto:varlamov@depni.npi.msu.ru); Worldwide Web: <http://cdfe.sinp.msu.ru/>; contact: V.V. Varlamov.

### For services to customers in China:

China Nuclear Data Center, China Institute of Atomic Energy, P.O. Box 275(41), Beijing 102413, China.  
Tel. +86 10-6935-7275; Fax +86 10-6935-7008; Email: [gezg@ciae.ac.cn](mailto:gezg@ciae.ac.cn); contact: Ge Zhigang.

### Computer codes of US origin to all countries (there are charges and release restrictions):

Radiation Safety Information Computational Center (RSICC), Oak Ridge National Laboratory,  
P.O. Box 2008, Oak Ridge, TN 37831-6362, USA.  
Tel. +1 865-574-6176; Fax +1 865-574-6182;  
Email: [pdcc@ornl.gov](mailto:pdcc@ornl.gov) Worldwide Web: <http://rsicc.ornl.gov/CustomService.aspx>

### Computer codes of non-US origin to all countries (there may be release restrictions):

NEA Data Bank (see above)  
Email: [Juan.Galan@oecd.org](mailto:Juan.Galan@oecd.org); contact: J. Galan, ext. 1008.

IAEA Nuclear Data Section offers data centre services primarily to non-OECD countries (except Russian Federation and China, see above). However, most products advertised in this Newsletter, specifically INDC reports, IAEANDS-documents, etc., are provided upon request to customers in all countries.  
IAEA-NDS on-line services at Worldwide Web: <http://www-nds.iaea.org/>  
Users in India and neighbouring countries may use  
IAEA-NDS mirror at Worldwide Web: <http://www-nds.indcentre.org.in>

## Impressum

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