

IAEA Nuclear Data Section: Progress Report for period 2013/14

Summary of Nuclear Data Activity by Staff of the IAEA Nuclear Data Section April 2013 – April 2014

R.A. Forrest, N. Otsuka, V. Semkova, S.P. Simakov, L. Vrapcenjak, V. Zerkin

IAEA Technical Meeting, 6-9 May 2014
Smolenice, Slovakia

Web: <https://www-nds.iaea.org/>
E-mail: nds.contact-point@iaea.org

1. Staff Changes

The authorized staff level of the Nuclear Data Section (NDS) consists of a total of 16.25 professionals and support staff. The latest staff changes include:

- Kyoko Viitaniemi (Section Secretary) took a reassignment in Joint FAO/IAEA Programme in June 2013.
- Rosalinda Rangel Alvarez (Section Secretary) joined in July 2013.
- Kira Nathani (Team Assistant) took a temporary reassignment in Environment Laboratories (Monaco) in October 2013.
- Ann Jensby (Team Assistant) took a temporary assignment in December 2013.
- Khalid Sheikh (Database Assistant) retired in December 2013.
- Andrej Trkov (Nuclear Physicist) joined in January 2014.

2. Compilations

2.1 EXFOR transmission

Since the last NRDC Meeting, the following final tapes have been transmitted:

- 5 neutron final TRANS tapes (3159 – 3162 and V032) containing 25 new entries and 54 revised entries;
- 9 CPND final TRANS tapes (D087 - D093, S016-S017) containing 106 new entries and 71 revised entries;
- 3 PhND final TRANS tapes (G026 - G028), containing 14 new entries and 23 revised entries.

Also 65 final TRANS tapes have been received at NDS. These final TRANS tapes contain 460 neutron entries (59 new, 401 revised), 516 CPND entries (326 new, 168 revised), 201 PhND entries (29 new, 172 revised) since the last NRDC Meeting.

Based on these finalized TRANS tapes, 14 EXFOR Master Files have been created and distributed.

Three regular transmissions of the EXFOR/CINDA dictionaries (TRANS.9106 - 9108) were done in TRANS, DANIEL (backup) and archive format.

Table: Number of new entries transmitted by final tapes since the last NRDC Meeting
(KazNU: Kazakhstan and Uzbekistan Group coordinated at Kaz National Univ.)

	NDS	ATOMKI	CNDC	KNDC	NDPCI	UkrNDC	KazNU	Sum
Neutron	11	-	3	1	6	4	0	25
CPND	18	21	6	0	47	7	7	106
PhND	4	-	0	2	2	6	0	14
Sum	33	21	9	3	55	17	7	145

2.2 EXFOR quality control

Since the last NRDC Meeting, 80 preliminary TRANS tapes were transmitted for checking by NDS and other centres. Both ZCHEX and JANIS TRANS Checker are regularly used. NDS also has registered comments on EXFOR entries from users to the EXFOR Feedback List (<https://www-nds.iaea.org/nrdc/error/>) and monitored the correction process by checking each preliminary TRANS tapes against the feedback list.

2.3 EXFOR coverage control

Under the EXFOR compilation control system, about 70 journal titles are regularly scanned and registered to the EXFOR Compilation Control System. The list of newly published articles for compilation (<https://www-nds.iaea.org/exfor-master/x4compil/>) is updated every week. Since the last NRDC Meeting, about 850 journal issues (of which 750 issues are from the regularly scanned journals and 100 issues are issues additionally scanned to improve coverage of Conf. Proc. etc.) have been scanned and added to the database for EXFOR compilation control system. Completeness checking of EXFOR against other specialises data libraries, such as NACRE II, IBANDL, Said Mughabghab's "Atlas of Neutron Resonances" was performed. The missing references were collected and assign for compilation according to the area of responsibilities. Both these newly published articles and old articles for retroactive compilation are also registered to a list of Articles Allocated for EXFOR Compilation.

2.4 Workshops and meetings relevant to EXFOR held and planned

- Workshop on EXFOR Compilation, 27–30 August 2013, Vienna, SO: N. Otsuka). See https://www-nds.iaea.org/nrdc/wksp_2013/ for presentation etc.
- Consultancy Meeting on EXFOR Data in Resonance Region and Spectrometer's Response Function, 8–10 October 2013, Vienna, SO: V Semkova). See the summary report INDC(NDS)-0647 (December 2013) and also <https://www-nds.iaea.org/index-meeting-crp/CM-RF-2013/> for presentation etc.

2.5 CINDA

The CINDA Master File is available via the NDS compilers' Web site (includes all components and history). Automatic updates using the EXFOR and NSR databases have been carried out twice (June 2013, January 2014). Complete MySQL CINDA database was sent to NNDC (USA), BARC (India) and CNDC (China).

2.6 Evaluated data libraries, files and programs

Various new and revised evaluated data libraries, files and programs for data checking, processing and graphical presentation were added, developed and distributed via the NDS Web site and on DVD-ROM (see below).

Last remaining programs DAN2X4 and NUC_DICT were ported from Alpha-VMS to Windows and Linux. (DAN2X4 produces official Dictionary TRANS file from DICT_ARC_NEW files; NUC_DICT extracts information from Nuclear Wallet Cards file and Audi-Wapstra Mass file and produces extended Dictionary-227.)

3. Services

3.1 Web Services

Further improvements have been implemented in the Web EXFOR-CINDA-ENDF-IBANDL retrieval systems since the last NRDC meeting:

- ENDF (Evaluated Nuclear Data Files):
 - ENDF-Archive: collection of evaluated data libraries (56) for FTP downloading: <http://www-nds.iaea.org/ndspub/download-endf/>
 - Plotting covariance and cross section data with uncertainties for production of radioactive nuclei (MF40 and MF10)
 - New evaluated libraries included in the ENDF database:
 - IRDFF-1.03: International Reactor Dosimetry and Fusion File, IAEA, 2014
 - JENDL-4.0u2 Update 2013 of Japanese evaluated nuclear data library 2010
 - JEFF-3.2 - Joint Evaluated Fission and Fusion File, coordinated by NEA Data Bank, 2014
 - TENDL-2012: TALYS-based Evaluated Nuclear Data Library, 2012
- EXFOR:
 - X4Plot: universal plotting of EXFOR data with arbitrary selection and grouping of columns
 - Version-2 of XML output of EXFOR files (includes schema, html-transformation, validation on w3.org)
 - New part of EXFOR database: updates and archive. The system stores and provides Web access to all versions of every Entry and Subentry: last updates, old data from Alpha-VMS and IBM, CD-ROMs, etc., tracking modifications in Subentry-text, and produces several summary reports

- EXFOR Web search by author using aliases
- 9 updates of PDF part of NDS EXFOR database were done; common PDF collection was established with NSR database: 6 updates (for authorized users only)
- IBANDL:
 - Web interface for IBANDL was extended by remote calling of SigmaCalc-2.0 (author: A.Gurbich) working on external Web server in Surrey University, UK
 - New feature allowing to upload and plot user's R33 file was developed
 - CD-ROM available for downloading via Web

News in Web-Tools for EXFOR compilers and ENDF/ENSDF evaluators:

- EXFOR uploading system: Web tool for coding EXFOR references (help for coding, search existing data in EXFOR, CINDA, NSR, PDF collection)
- ENDF uploading system: PREPRO-2012 for pre-processing and fudge-4.0 for converting ENDF formatted user's file to GND (LLNL, USA) are working on Web
- ENSDF uploading system: RADLIST was added
- Web-interface to EMPIRE-3.1 (experimental version): allows remote calculations with Empire-3.1 modelling code, connected to ENDF uploading system, and therefore allows running on Web: ENDF utility codes, PREPRO, fudge, plotting and comparing results of calculations with other ENDF libraries and EXFOR data.

NDS Web services joined common IAEA Web statistics system based on Google-Analytics.

The Web EXFOR-CINDA-ENDF retrieval system is functioning at NNDC (USA), BARC (India) and CNDC (China). Statistics for usage of the Web retrieval system are presented in figures below.

3.2 DVD-ROM

DVD "Nuclear reaction libraries, database retrieval systems and applications" contains:

- EXFOR/CINDA for Windows
- EXFOR/CINDA for Applications (Linux, Windows and Mac OSX)
- EndVer/GUI with Prepro-2012 (Linux, Windows and Mac OSX)
- ENDF Libraries (30)

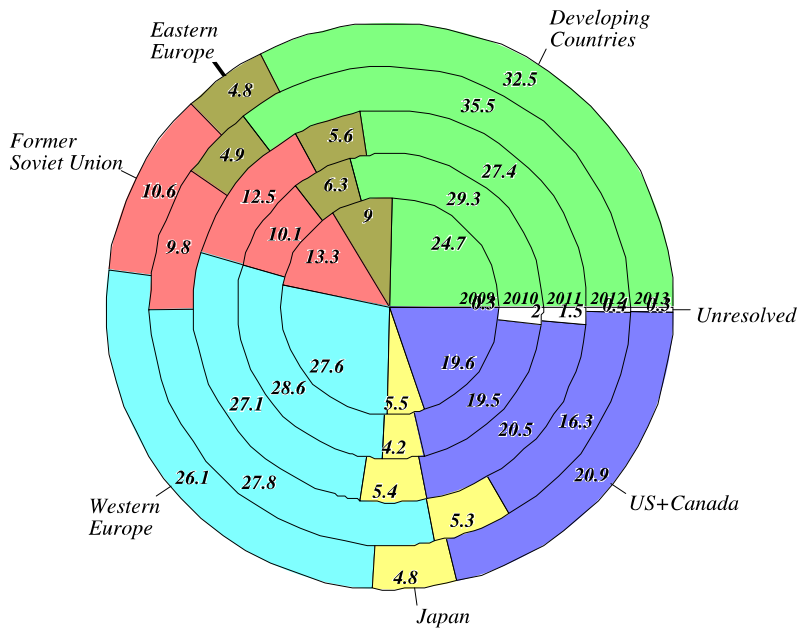
News in CD/DVD distribution:

- IBANDL for Windows (distribution resumed)
- Portable Empire-3.2.2 for Windows (new): does not require installation; available for downloading on NDS Web site
- Fifteen CD/DVD-ROMs (from 24 in total) became available for downloading from NDS Web site excluding access from crawlers and robots

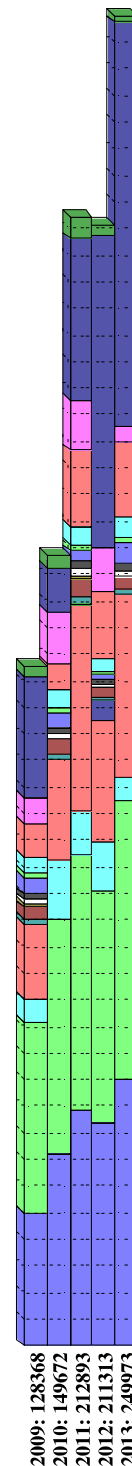
IAEA Nuclear Data Services: Web Statistics

2009-2013

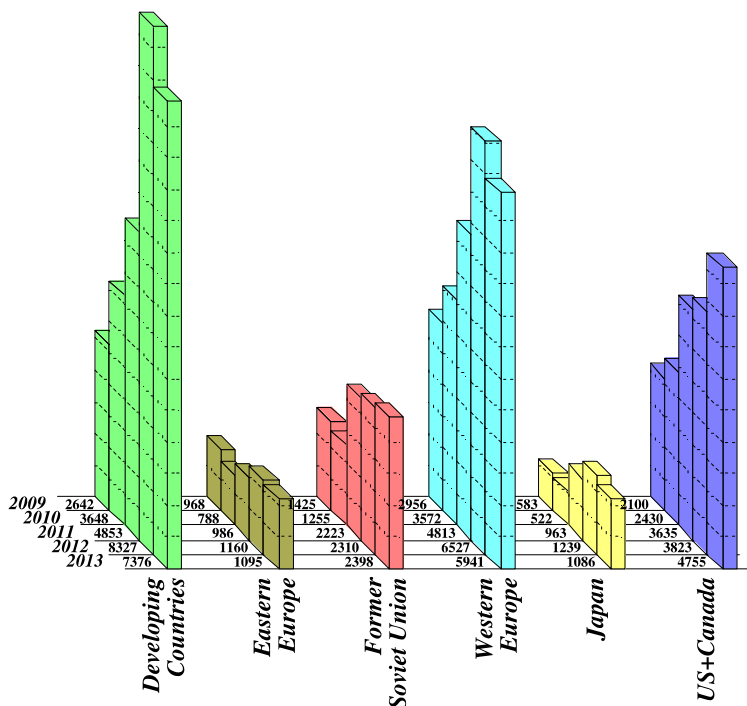
Geographical Distribution (%)



Total per Year
(Number of accesses + retrievals)



Average per Month
(Number of accesses + retrievals)



- | Service | Comment |
|------------------------|--------------|
| Computer Codes | |
| Documents | |
| OtherData | |
| IBANDL | |
| PGAA | |
| PhotoNuclear | |
| RIPL | Theory |
| FENDL | Fusion |
| Masses | |
| IRDF | Dosimetry |
| Thermal Capture | |
| Wallet Cards | |
| Med.Radioisotope.Prod. | |
| NGAtlas | Activation |
| RNAL | |
| ENSDF | Structure |
| MIRD | Medical |
| NuDat/LiveChartNucl | |
| CINDA+NSR Bibliography | |
| EXFOR | Experimental |
| ENDF | Energy |

3.3 Code Services

The following new or recently updated codes have been made publically available on the NDS web page since the last NRDC meeting:

- **COVEIG** - code to calculate eigenvalues of covariance matrices in an ENDF file. The code is available on-line <https://www-nds.iaea.org/IRDF/coveig.for>
- **GDGraph** Ver.5.0 – code to digitize data points on images, available on-line https://www-nds.iaea.org/nrdc/nrdc_sft/gdgraph50.zip with an English manual (Report IAEA-NDS-216).
- **PLOTTAB** - utility code to plot continuous curves and/or discrete physical data, available on-line <https://www-nds.iaea.org/plottab/>
- **RR_UNC** – code to calculate uncertainties in reaction rates and cross sections. The code is available on-line https://www-nds.iaea.org/IRDF/rr_unc.for
- **SPECOMP** - code for determining displacement cross sections for compound materials, available on <https://www-nds.iaea.org/irdf2002/codes/index.htmlx>.
- **STAYSL PNNL** – software suite for reactor dosimetry, available on <https://www-nds.iaea.org/irdf2002/codes/index.htmlx>

3.4 Document Services

Nuclear Data Services Unit (NDSU) continued supporting the Member States in providing the reports published, as well as distributing data libraries on CDs and DVDs as requested. Following the trends, most of data libraries which are available from CDs/DVDs are now also available from webpage (<https://www-nds.iaea.org/cdroms/>) for download to ensure quicker and easier service.

As mentioned in the previous report, together with the main IAEA library, the process of cataloguing of all documents in NDS library was started. Currently 2/3 of the project is already finished and a number of records at the moment reached 1820. Within this project we were able to trace many of the very old reports which we were not able to find elsewhere. In addition, this project will also include the cataloguing of all the Conference proceedings that NDS has available in hardcopy (330 books dating from 1957-present day). For the meantime, an internal webpage catalogue of all proceedings was prepared.

Since the publications web page was made available for public use in 2011, it has become one of the most accessed sections of the www-nds web site.

NDSU continues supporting the compilers around the world by collecting references required for compilation and research work as the availability of source articles is important for EXFOR quality control by NDS. NDSU also published several INDC country reports (INDC(EUR)-032 and INDC(GER)-0052) prepared by experimentalists to provide unpublished experimental information to EXFOR compilers and users. Also papers presented by data centres and other laboratories in the "4th AASPP Workshop on Nuclear Reaction Database (Almaty, October 2013)" were edited with the organizer and published as INDC(KAS)-001.

Upon request of many of meeting participants, new website was also created

(https://www-nds.iaea.org/index_nds_meetings.htm) allowing access to all presentations from various meetings hosted by the NDS.

Any other improvement suggestions should be sent to our contact address

NDS.Contact-Point@iaea.org.

3.5 Nuclear Data Newsletters

The Nuclear Data Newsletter is published biannually to inform the scientific community about actual NDS work: # 55 was issued in May 2013; # 56 was issued in November 2013; #57 is in preparation. Distribution: 1596 on-line and 127 as hard copies.

4. Visits and Inter-centre Cooperation

- V. Zerkin (NDS) visited NNDC from 2 to 20 September 2013 to deploy and further develop software for the management and the web retrieval of ENDF, EXFOR and CINDA databases. To work together on the development of XML for EXFOR and ENDF data formats.

5. Nuclear Data Developments

The Nuclear Data Section undertakes long term nuclear data development by implementing Coordinate Research Projects (CRP) and Data Development Projects (DDP). The staff members of NDS who manage NRDC also follow the currently running CRPs and DDPs to observe the actual trends and needs for nuclear reaction data.

5.1. On-going Coordinated Research Projects (CRPs) Meeting Held and Planned:

- **International Reactor Dosimetry Library for Fission and Fusion (IRDF) Testing and Validation** (2013-2017): 1st RCM on 1-5 July 2013;
- **Reference Database for Beta-delayed Neutron Emission Evaluation** (2013-2017): 1st RCM on 26-30 August 2013;
- **Prompt Fission Neutron Spectra of Actinides** (2010-2014): 3rd RCM on 21-24 October 2013;
- **Primary Radiation Damage Cross Sections** (2013-2017): 1st RCM on 4-8 November, 2013;
- **Development of a Reference Database for Particle-induced Gamma Ray Emission (PIGE) Spectroscopy** (2011-2015): 3rd RCM on 7-11 April, 2014;
- **Nuclear Data for Charged-particle Monitor Reactions and Medical Isotope Production** (2012-2016): 2nd RCM on 8-12 December, 2014;

5.2. Data Development Projects (DDP) Meeting Held and Planned:

- **Maintain the international neutron cross section standards file and evaluation techniques:** TM on “Toward a New Evaluation of Neutron Standards”, 8-12 July 2013; TM on “Current Status of Neutron Standards”, 1-5 December 2014.
- **CIELO collaboration: coordination and technical work:** CM on “CIELO – Working meeting on U-238 evaluation”, 22-26 September 2014.
- **Ion Beam Analysis Nuclear Data Library (IBANDL):** CM on “Accuracy of Experimental and theoretical Nuclear Cross Sections for Ion Beam Analysis and Benchmarking”, 11-13 March 2013;
- **Compilation and evaluation of gamma-ray data:** CM on “Compilation and Evaluation of Gamma-Ray Data”, 4-6 November 2013.

6. Nuclear Data Publications (2013-2014)

Combination of resonance integral and Maxwellian 30 keV data – A sensitive test of the resonance region

J. Kopecky, R.A. Forrest, Fusion Eng. Design **88** (2013) 177-187

High-sensitivity isobar-free AMS measurements and reference materials for ^{55}Fe , ^{68}Ge and $^{202\text{g}}\text{Pb}$

A. Wallner, M. Bichler, K. Buczak, D. Fink, O. Forstner, R. Golser, M.A.C. Hotchkis, A. Klix, A. Krasa, W. Kutschera, C. Lederer, A. Plompen, A. Priller, D. Schumann, V. Semkova, P. Steier, J. Nucl. Instr. Meth. Phys. Res. B294 (2013) 374-381

Measurement of Neutron Activation Cross Sections on Mo isotopes in the Energy Range from 7 MeV to 15 MeV

V. Semkova, R. Nolte, EPJ Web of Conf. **66** (2014) 03077

Recent Developments in the Experimental Nuclear Reaction Data Library EXFOR

V. Semkova, N. Otuka, S. Simakov, V. Zerkin, EPJ Web of Conf. **66** (2014) 03078

Activation cross-sections of deuteron-induced nuclear reactions on natural iron up to 24 MeV

M.U. Khandaker, H. Haba, J. Kanaya, N. Otuka, Nucl. Instrum. Meth. Phys. Res. B **316**(2013) 33-41

Excitation functions of (d,x) nuclear reactions on natural titanium up to 24 MeV

M.U. Khandaker, H. Haba, J. Kanaya, N. Otuka, Nucl. Instrum. Meth. Phys. Res. B **296** (2013) 14-21

Nuclear Data Sheets for A=211

B. Singh, D. Abriola, C. Baglin, P. Demetriou et al, Nucl. Data Sheets **114** (2013) 661-749

Investigation of α -induced reactions on the p nucleus ^{168}Yb

L. Netterdon, P. Demetriou, J. Endres, U. Giesen, G.G. Kiss, A. Sauerwein, T. Szücs, K.O. Zell, A. Zilges, Nucl. Phys. A **916** (2013) 149-167

Cross section measurements of proton capture reactions relevant to the p process: The case of $^{89}\text{Y}(p,\gamma)^{90}\text{Zr}$ and $^{121,123}\text{Sb}(p,\gamma)^{122,124}\text{Te}$

S. Harissopulos, A. Spyrou, A. Lagoyannis, M. Axiotis, P. Demetriou, J.W. Hammer, R. Kunz, H.-W. Becker, Phys. Rev. C **87** (2013) 025806

Nuclear Data Sheets for A = 215

B. Singh, G. Mukherjee, D. Abriola, S. Basu, P. Demetriou et al., Nucl. Data Sheets **114** (2013) 2023-2078

Results of total cross section measurements for ^{197}Au in the neutron energy region from 4 to 108 keV at GELINA

I. Sirakov, B. Becker, R. Capote, E. Dupont, S. Kopecky, C. Massimi and P. Schillebeeckx, Eur. Phys. J. A **49** (2013) 144

A dispersive optical model potential for nucleon induced reactions on ^{238}U and ^{232}Th nuclei with full coupling

Jose Manuel Quesada, Efrem S. Soukhovitski, Roberto Capote, and Satoshi Chiba, EPJ Web of Conf. **42** (2013) 02005

Dispersive coupled-channels optical-model potential with soft-rotator couplings for Cr, Fe, and Ni isotopes

Li Rui, Sun Weili, E. Sh. Soukhovitski, J.M. Quesada, R. Capote, Phys. Rev. C **87** (2013) 054611

Measurement and modeling of the cross sections for the reaction $^{230}\text{Th}(^3\text{He},3n)^{230}\text{U}$

A. Morgenstern, K. Abbas, F. Simonelli, R. Capote, M. Sin, B. Zielinska, F. Bruchertseifer, C. Apostolidis, Phys. Rev. C **87** (2013) 064602

Impact of model defect and experimental uncertainties on evaluated output

D. Neudecker, R. Capote, H. Leeb, Nucl. Instrum. Meth. A **723** (2013) 163-172

Measurement of the MACS of $^{181}\text{Ta}(n,\gamma)$ at $kT=30$ keV as a test of a method for Maxwellian neutron spectra generation

J. Praena, P.F. Mastinu, M. Pignatari, J.M. Quesada, J. Garcia-Lopez, M. Lozano, N. Dzysiuk, R. Capote, G. Martin-Hernandez, Nucl. Instrum. Meth. A **727** (2013) 1-6

The $^{93}\text{Zr}(n,\gamma)$ reaction up to 8 keV neutron energy

G. Tagliente, R. Capote, et al., (n_TOF Collaboration), Phys. Rev. C **87** (2013) 014622