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## Summary Report of the Technical Meeting on International Network of Nuclear Reaction Data Centres

Congress Centre of Slovak Academy of Sciences, Smolenice, Slovakia

6 – 9 May 2014

Prepared by

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June 2014

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**Abstract**

This report summarizes the IAEA Technical Meeting on the International Network of Nuclear Reaction Data Centres held in the Congress Centre of Slovak Academy of Sciences in Smolenice, Slovakia, hosted by Slovak Academy of Sciences, from 6 to 9 May 2014. The meeting was attended by 22 participants representing 13 cooperative Centres from 8 Member States (China, Hungary, India, Japan, Korea, Russia, Ukraine and USA) and 2 International Organisations (NEA, IAEA) as well as 2 participants from Kazakhstan. A summary of the meeting is given in this report along with the conclusions and actions.



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## THE INTERNATIONAL NETWORK OF NUCLEAR REACTION DATA CENTRES

National, regional and specialized nuclear reaction data centres, coordinated by the International Atomic Energy Agency, cooperate in the compilation, exchange and dissemination of nuclear reaction data in order to meet the requirements of nuclear data users in all countries. At present, the following data centres participate in the network:

NNDC	US National Nuclear Data Center, Brookhaven National Laboratory, Upton, USA
NEA DB	OECD NEA Data Bank, Issy-les-Moulineaux, France
NDS	IAEA Nuclear Data Section, Vienna, Austria
CJD	Russian Nuclear Data Centre, Institute of Physics and Power Engineering, Obninsk, Russia
CNDC	China Nuclear Data Centre, China Institute of Atomic Energy, Beijing, China
ATOMKI	Charged-Particle Nuclear Reaction Data Group, Institute for Nuclear Research (ATOMKI), Debrecen, Hungary
NDPCI	Nuclear Data Physics Centre of India, Bhabha Atomic Research Centre, Trombay, Mumbai, India
JAEA/NDC	Nuclear Data Center, Japan Atomic Energy Agency, Tokai-mura, Japan
JCPRG	Nuclear Reaction Data Centre, Hokkaido University, Sapporo, Japan
KNDC	Nuclear Data Center, Korea Atomic Energy Research Institute, Daejeon, Republic of Korea
CDFE	Centre for Photonuclear Experiments Data, Moscow State University, Moscow, Russia
CNPD	Centre of Nuclear Physics Data, Institute of Nuclear and Radiation Physics, Russian Federal Nuclear Center –All-Russia Research Institute of Experimental Physics, Sarov, Russia
UkrNDC	Ukrainian Nuclear Data Centre, Institute for Nuclear Research, Kyiv, Ukraine

A detailed description of the objectives of the network and the contributions of each Centre to these activities are given in INDC(NDS)-401 (Rev.6), "International Network of Nuclear Reaction Data Centres".

## PREVIOUS NRDC MEETINGS

Smolenice, 6-9 May 2014	Centre Heads+ Technical	INDC(NDS)-0661
Vienna, 23-25 April 2013	Technical	INDC(NDS)-0633
Paris, 16-19 April 2012	Centre Heads + Technical	INDC(NDS)-0618
Vienna, 23-24 May 2011	Technical	INDC(NDS)-0593
Sapporo, 20-23 April 2010	Centre Heads + Technical	INDC(NDS)-0573
Vienna, 25-26 May 2009	Technical	INDC(NDS)-0558
Obninsk+Moscow 22-25 Sept. 2008	Centre Heads + Technical	INDC(NDS)-0536
Vienna, 8-10 October 2007	Technical	INDC(NDS)-0519
Vienna, 25-28 September 2006	Centre Heads + Technical	INDC(NDS)-0503
Vienna, 12-14 October 2005	Technical	INDC(NDS)-0480
Brookhaven, 4-7 October 2004	Centre Heads + Technical	INDC(NDS)-464
Vienna, 17-19 June 2003	Technical	INDC(NDS)-446
Paris, 27-30 May 2002	Centre Heads + Technical	INDC(NDS)-434
Vienna, 28-30 May 2001	Technical	INDC(NDS)-427
Obninsk, 15-19 May 2000	Centre Heads + Technical	INDC(NDS)-418
Vienna, 18-20 May 1999	Technical	INDC(NDS)-407
Vienna, 11-15 May 1998	Centre Heads + Technical	INDC(NDS)-383
Vienna, 26-28 May 1997	Technical	INDC(NDS)-374
Brookhaven, 3-7 June 1996	Center Heads + Technical	INDC(NDS)-360
Vienna, 2-4 May 1995	Technical	INDC(NDS)-343
Paris, 25-27 April 1994	Center Heads + Technical	INDC(NDS)-308
Vienna, 1-3 Sept 1992	Technical	INDC(NDS)-279
Obninsk, 7-11 Oct 1991	Center Heads + Technical	INDC(NDS)-0262
Vienna, 13-15 Nov 1990	Technical	Memo CP-D/210
Vienna, 2-4 Oct 1989	Centre Heads + Technical	Memo CP-D/200
Vienna, 4-6 Oct 1988	Technical	Memo CP-D/190
Brookhaven, 27-29 Oct 1987	Center Heads + Technical	INDC(NDS)-204
Vienna, 7-9 Oct 1986	Technical	Memo CP-D/159
Saclay, 9-11 Oct 1985	Center Heads + Technical = 8 <sup>th</sup> NRDC Meeting	INDC(NDS)-178
Vienna, 19-21 Sept 1984	Technical	Memo CP-D/131
Obninsk+Moscow, 17-21 Oct 1983	7 <sup>th</sup> NRDC Meeting	INDC(NDS)-154
Vienna, 3-7 May 1982	6 <sup>th</sup> NRDC Meeting	INDC(NDS)-141
Brookhaven, 29.9 - 2.10.1980	5 <sup>th</sup> NRDC Meeting	INDC(NDS)-125
Karlsruhe, 8-13 Oct 1979	4 <sup>th</sup> NRDC Meeting	INDC(NDS)-110
Paris, 19-23 June 1978	3 <sup>rd</sup> NRDC Meeting	INDC(NDS)-99
Kiev, 11-16 April 1977	2 <sup>nd</sup> NRDC Meeting = 3 <sup>rd</sup> CPND + 13th 4-C	INDC(NDS)-90
Vienna, 28-30 April 1976	2 <sup>nd</sup> CPND Meeting	INDC(NDS)-77
Vienna, 26-27 April 1976	12 <sup>th</sup> 4C-Meeting	INDC(NDS)-78
Vienna, 8-12 Sept 1975	CPND Meeting	INDC(NDS)-69+71
Brookhaven, 10-14 March 1975	11 <sup>th</sup> 4C-Meeting	INDC(NDS)-68
Paris, 6-10 May 1974	10 <sup>th</sup> 4C Meeting	INDC(NDS)-58
Vienna, 24-26 April 1974	CPND + PhotoND	INDC(NDS)-59+61
Moscow/Obninsk, 4-8 June 1973	9 <sup>th</sup> 4C Meeting	INDC(NDS)-54
Vienna, 16-20 Oct 1972	8 <sup>th</sup> 4C Meeting	INDC(NDS)-51
Brookhaven, 25-29 Oct 1971	7 <sup>th</sup> 4C Meeting	INDC(NDS)-41
Paris, 5-9 Oct 1970	6 <sup>th</sup> 4C Meeting	INDC(NDS)-28
Moscow, 17-21 Nov 1969	5 <sup>th</sup> 4C Meeting	INDC(NDS)-16



## LIST OF ACRONYMS

ATOMKI	Nuclear Research Institute, Debrecen, Hungary
BARC	Bhabha Atomic Research Centre, Trombay, Mumbai, India
BNL	Brookhaven National Laboratory, Upton, New York, USA
BROND	Russian Evaluated Neutron Reaction Data Library
C4	Computational format for EXFOR data
CAJaD	Centre for Nuclear Structure and Reaction Data, Kurchatov Institute, Moscow, Russia
CDFE	Centr Dannykh Fotojad. Eksp., Moscow State University, Russia
CENDL	Chinese Evaluated Neutron reaction Data Library
CHEX	EXFOR check program (originating from NNDC)
CIAE	Chinese Institute of Atomic Energy, Beijing, China
CINDA	A specialized bibliography and data index on nuclear reaction data operated by NRDC
CJD	Russian Nuclear Data Centre, IPPE, Obninsk, Russia
CNDC	China Nuclear Data Centre, CIAE, Beijing, China
CNPD	Centre of Nuclear Physics Data at RFNC-VNIIEF, Sarov, Russia
CP...	Numbering code for memos exchanged within the NRDC
CPND	Charged-particle nuclear reaction data
CRP	Coordinated Research Project (of the IAEA Nuclear Data Section)
CSEWG	US Cross Section Evaluation Working Group
DOI	Digital Object Identifier, <i>e.g.</i> for bibliographic references
EFF	European Fusion File, coordinated by NEA-DB
EMPIRE	A code system for nuclear reaction model calculations
ENDF-6	International format for evaluated data exchange, version 6
ENDF/B	US Evaluated Nuclear Data File/B
ENSDF	Evaluated Nuclear Structure Data File
EXFOR	Format for the international exchange of nuclear reaction data
GSYS	Data digitizing system by JCPRG
IAEA	International Atomic Energy Agency, Vienna, Austria
IBANDL	Ion Beam Analysis Nuclear Data Library, maintained at IAEA
INDC	International Nuclear Data Committee
IPPE	Institute of Physics and Power Engineering, Obninsk, Russia
IRDF	International Reactor Dosimetry and Fusion File, maintained by the IAEA-NDS

JAEA	Japan Atomic Energy Agency
JANIS	Java Nuclear Information System of NEA-DB
JCPRG	Nuclear Reaction Data Centre, Hokkaido University, Sapporo, Japan
JEFF	Joint Evaluated Fission and Fusion File, coordinated by NEA-DB
JENDL	Japanese Evaluated Nuclear Data Library
KAERI	Korea Atomic Energy Research Institute, Daejeon, Korea
KNDC	Nuclear Data Center, KAERI, Daejeon, Korea
KINR	Kyiv Institute of Nuclear Research
LEXFOR	Part of the EXFOR manual containing physics information for compilers
NDS	IAEA Nuclear Data Section, Vienna, Austria
NEA	OECD Nuclear Energy Agency, Issy-les-Moulineaux, France
NEA-DB	OECD/NEA Data Bank, Issy-les-Moulineaux, France
NEANDC	OECD/NEA Nuclear Data Committee
NNDC	National Nuclear Data Center, Brookhaven National Laboratory, USA
NRDC	International Network of Nuclear Reaction Data Centres
NRDF	Japanese Nuclear Reaction Data File
NSDD	International Network of Nuclear Structure and Decay Data Evaluators
NSC	OECD/NEA Nuclear Science Committee
NSR	Nuclear Science References, a bibliographic system
OECD	Organization for Economic Cooperation and Development, Paris, France
ORDER	EXFOR program for addition of record identification
PhND	Photonuclear data
RIKEN	Institute of Physics and Chemistry Research, Wako-Shi, Saitama, Japan
TRANS	Name of transmission tapes for data exchange in the EXFOR system
UKRNDC	Ukraine Nuclear Data Centre at KINR, Kyiv, Ukraine
VNIIEF	Russian Federal Nuclear Centre, Sarov, Russia
WPEC	Working Party on International Nuclear Data Evaluation Co-operation
XTRACT	EXFOR indexing program
X4TOC4	Conversion program from EXFOR to computational format "C4"
ZCHEX	Current version of CHEX, updated and maintained by NDS
4C...	Numbering code of memos exchanged among the four Neutron Data Centres

# MEETING SUMMARY

## 1. Introduction

The IAEA Technical Meeting on the International Network of Nuclear Reaction Data Centres was held in the Congress Centre of Slovak Academy of Sciences in Smolenice, Slovakia, hosted by Slovak Academy of Sciences, from 6 to 9 May 2014. The meeting was attended by 22 participants representing 13 cooperative Centres from 8 Member States (China, Hungary, India, Japan, Korea, Russia, Ukraine and USA) and 2 International Organisations (NEA, IAEA) as well as 2 participants from Kazakhstan (see **Appendix A**). Meetings of this network are held annually, with full meetings involving Centre Heads and technical staff every two years (last full meeting was held in April 2012 at the OECD Nuclear Energy Agency, Issy-Les-Moulineaux, France).

Main topics of the present meeting were transmission statistics, compilation responsibility, compilation needs, coverage and quality control, dictionaries, manuals, coding rules as well as tools for compilation and dissemination (see **Appendix B**).

Totally 56 working papers were presented at the meeting. The results of the discussions were summarized in 31 conclusions and 89 actions (see **Appendix C**).

## 2. Brief Summary

### 2.1 Opening

**S. Hlaváč**, Director of the Institute of Physics of Slovak Academy of Sciences (SAS) welcomed the participants and also introduced the SAS and a plan for construction of a new Tandetron for neutron-induced reaction data measurement.

**R. Forrest**, Head of the IAEA Nuclear Data Section (NDS) introduced the background and the objects of the meeting. He mentioned that the NDS organised several meetings in 1980s and 1990s in this castle. He also emphasized that NDS recognizes EXFOR compilation as a very important activity of the Section.

**E. Dupont** was elected as Chairman, and the agenda was adopted without change.

### 2.2 Progress Reports

Progress reports from all thirteen attending Centres were presented by **A. Saxena**, **S. Taova**, **F. Tárkányi**, **O. Iwamoto**, **Ge Zhigang**, **R. Forrest**, **M. Mikhaylyukova**, **K. Matsumoto**, **E. Dupont**, **M. Aikawa**, **V. Varlamov**, **O. Gritzay**, **Y. O. Lee** and **B. Pritychenko**, who highlighted the staffing, compilation, dissemination and other nuclear data related activities of interest to the network. See also the progress reports P2013-01 to P2013-11 for further details (see **Appendix D**).

### 2.3 EXFOR General

**V. Semkova** presented the statistics of transmissions, journal scanning and preliminary tape checking. She reported that 538 new entries and 863 revised entries have been newly finalized since the last NRDC meeting. She also mentioned that NDS regularly scans about 65 journals during

2013. Finally she reported that both NEA DB and NDS submit comments on all preliminary tapes, and CJD also submits comments on many preliminary tapes for neutron-induced reaction data.

**N. Otsuka** presented his analysis of compilation time (= time of transmission – time of publication) for eight selected journals (covering 67% of all registered articles) published in 2013. His analysis showed that the compilation time is 6.3 months on average, which is similar to that reported in the last NRDC meeting for articles published in 2012 (5.6 months). He also reported progress in corrections of the entries registered in the EXFOR Feedback List. He noted that NNDC, NEA DB and CJD still have to correct more than 100 mistakes, but the recently transmitted preliminary tapes by NEA DB will fix almost all mistakes in the entries maintained by NEA DB.

**N. Otsuka** reported that he was informed by S. Babykina and A. Ogloblin (Kurchatov Institute) in 2013 that CAJaD will stop its work on compilation. He proposed to transfer the responsibility of area B entry maintenance from CAJaD to NDS, and transfer all other responsibilities from CAJaD to CNPD. He also reported that some nuclear physicists in Almaty and Tashkent started the collection of data measured in Kazakhstan and Uzbekistan, and proposed compilation of experimental data from these countries for EXFOR by the CANRDB group (Central Asian Nuclear Reaction Database) on a trial basis. Both CNPD and the CANRDB group accepted his proposal, and the participants also welcomed it. See **Appendix G** for the revised compilation responsibility.

## 2.4 Manuals and Dictionaries

**N. Otsuka** introduced the revised NRDC Protocol (IAEA-NDS-215) and Network Document (INDC(NDS)-0401) as well as revisions of LEXFOR and the Formats Manual for digitization and covariance, and they were all approved. The participants also agreed to replace “systematic” with “partial” in the expansion of the data headings  $ERR-1$ ,  $ERR-2$  etc.

## 2.5 CINDA

**V. Zerkin** reported that the CINDA Master File was updated twice since the last NRDC meeting (June 2013 and January 2014) including imports from the EXFOR and NSR databases. A MySQL dump of the complete CINDA database was sent to BARC, CNDC and NNDC.

## 2.6 EXFOR Compilation Needs

**V. Semkova** presented progress in compilation of data related to various needs (*e.g.*, neutron source reactions, charged-particle induced isotope production cross sections, Maxwellian averaged cross sections). She reported that ATOMKI, CNDP, JCPRG, NEA DB and NNDC still need to compile a part of the articles listed in past NRDC meetings. An updated list of articles for compilation with priority was distributed.

**V. Semkova** introduced the EXFOR template and recommendations to NDS, NRDC and EXFOR compilers formulated by the IAEA Consultants’ Meeting on “EXFOR Data in Resonance Region and Spectrometers’ Response Function” (Vienna, 8-10 October 2013, INDC(NDS)-647). The neutron data compilers were encouraged to request key information on time-of-flight spectra from the experimentalists by using the EXFOR template.

**N. Otsuka** presented the result of EXFOR completeness checking against Mughabghab’s “Atlas of Neutron Resonances”, NACRE (Nuclear Astrophysics Compilation of Reactions) compilation, and data centres were asked to compile the articles missing in EXFOR with high priority.

**S. Simakov** presented the IAEA CRP on “Testing and Improving the International Reactor Dosimetry and Fusion File (IRDFF)” in relation with EXFOR compilation. He stressed the importance of compilation of the neutron spectra (produced by reactors or accelerators), spectrum averaged cross sections and decay parameters of reaction residuals, which are published in old and new literature or request such information from authors otherwise. He also pointed at the possible extension of EXFOR by inclusion of point or energy averaged cross sections from the SINBAD (Shielding Integral Benchmark and Database) and ICSBEP (IInternational Criticality Safety Benchmark Evaluation Project) databases.

**V. Semkova** proposed extension of the compilation scope to include  $\beta$ -delayed neutron spectra for neutrons emitted from a specific precursor in relation with the IAEA CRP on “Reference Database for Beta-Delayed Neutron Emission”. The proposed extension and coding rules were approved by the participants. In addition a new coding rule for the multiple beta-delayed neutron emission probability and multiplicity in cases when  $Q_{\beta^-} - S_{xn} > 0$  ( $x \geq 2$ ) was presented.

## 2.7 EXFOR Quality Control

**N. Otsuka** summarized the duplication of data sets created from the same reference, duplication of data sets from preliminary and final results for intermediate energy proton-induced activation cross sections measured by A.R. Balabekyan et al. and R. Michel et al.

**N. Otsuka** proposed addition of English translation information for Zhurnal Eksperimental'noi i Teoret. Fiziki (Soviet Physics JETP), Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki, Pis'ma v Redaktsiyu (JETP Letters), Doklady Akademii Nauk (Soviet Physics Doklady) and Izvestiya Akademii Nauk Ser. Fiz. (Bulletin of the Academy of Sciences Ser. Physics), and this was approved. He also reminded CJD to add English translation information to about 370 entries for Atomnaya Energiya (Soviet Atomic Energy), Yadernaya Fizika (Soviet Journal of Nuclear Physics) and Yadernaya Konstanty (Nuclear Constants).

**N. Otsuka** compared the number of entries which (1) contain the NODATA record, (2) have the status code UNOBT (data unobtainable from the author), and (3) do not have the status code PRELIM (preliminary data) or SPSSDD (data superseded) for each area in March 2010 and April 2014, and pointed out that NNDC successfully reduced the number of such entries.

**V. Zerkin** presented the EXFOR Archival Database containing 8 sources (*e.g.*, common EXFOR Master File 2005, official TRANS tapes). He noted that the new database can be used together with the EXFOR Web uploading system during compilation and for data checking. He also encouraged centres to find old TRANS tapes missing in the EXFOR Archive Database. He reported that 71 entry numbers found in the Archival Database are missing in the current EXFOR Master File.

**M. Mikhaylyukova** pointed that such missing entry numbers are seen in comparison with CINDA. She proposed to restore such entries, and it was agreed by the participants.

## 2.8 EXFOR Coding Rule

**V. Zerkin** reported that he found coincident values of independent variables in 4176 datasets of 1744 entries (excluding data sets defined with RAW in the REACTION code and also data sets tabulated with heading FLAG, MISC or MONIT\*). He noted that the list of the identified data sets is available on the NDS website.

**N. Otsuka** proposed revisions of the LEXFOR entries “Neutron yields”, “Fission yields”, and “Thermonuclear reaction rate” with related updates of the dictionaries. He also proposed a new

coding rule for the data sets of inclusive reactions (*e.g.*, REACTION SF<sub>3</sub>=X) presented with the excitation energy. All these proposals were approved. **Y.O. Lee** proposed to check if inclusion of the inelastic scattering in the denominator of the  $\eta$  value definition in the LEXFOR entry “Neutron yields” is appropriate, and he agreed to assess the relevant articles compiled in EXFOR.

**O. Schwerer** presented revisions of the LEXFOR entries “History” and “Partial reactions”. He also proposed addition of a new heading  $T_{KE}$  for the total kinetic energy and the relevant LEXFOR update, and all his proposals were approved.

**N. Otsuka** introduced recent examples of data corrected or derived by other than the experimentalist to clarify the NRDC policy for compilation of such data sets. The participants agreed that (1) compilation of data sets renormalized by other than the authors will not be recommended; (2) compilation of data sets corrected by other than the authors will be mandatory when the corrected data sets are well documented in a peer-reviewed journal with the correction procedure; (3) compilation of data sets derived by other than the authors will not be done in general, but may be compiled exceptionally when there is a strong need from EXFOR users and the derived data sets are well documented in a peer-reviewed journal with the derivation procedure. The participants also agreed that the corrected or derived data sets will be compiled in a separate entry to clearly distinguish such data sets from the original experimental data sets.

## 2.9 Software and Dissemination

**G. Pikulina** introduced the current situation of the digitizer InpGraph. She explained that there are two branches – (1) a new version InpGraph 3.0 which is under development, and (2) an updated version InpGraph 2.4 which has been released.

**S. Taova** introduced two estimations of digitization error – (1) standard deviation of the digitized value and true value on tics, and (2) quantization error corresponding to the size of a pixel. She concluded that the larger one could be suitable as the digitizing error to be kept in the EXFOR entry. **N. Otsuka** commented that these two definitions give a similar estimation on the example presented by Taova if we define the quantization error by the pixel size divided by a factor 2, and this may indicate that the both definitions give a reasonable estimate of the digitization error when quantization is the main source of the digitization error.

**Chen Guochang** introduced the latest version of the digitizer GDGraph (Ver.5). He noted that an English version of Ver. 5 is available on both the NRDC and CNDC web page, and the English manual is published as the report IAEA-NDS-0216.

**G. Pikulina** reported development and improvement of the EXFOR editor. She reported that the EXFOR-Converter System was incorporated in the editor in the latest version (Ver. 2.4) in order to produce an EXFOR+ output for proof-reading by authors.

**M. Aikawa** presented the current situation of the editor HENDEL and digitizer GSYS. He mentioned that HENDEL is used by former JCPRG members in India, Kazakhstan and Mongolia in addition to the current JCPRG members. He also reported that there were three minor updates of GSYS since the last NRDC Meeting (GSYS 2.4.4, 2.4.5 and 2.4.6), and a major update to Ver. 2.6 is planned in the near future.

**V. Zerkin** presented his development of EXFOR-XML. He reported that developments of elements of technology (*e.g.*, XSD schema, online validation) were done in 2013, and also noted that WPEC SG38 is going to have a low-level container “Table” compatible with EXFOR-XML. He also introduced a new web interface for EMPIRE-3.1 calculations, and mentioned that online comparison of the calculated result with ENDF and EXFOR as well as conversion to the GND

format are possible on the NDS web page. He also noted that a new package of EMPIRE (EMPIRE-3.2.2 Portable for Windows) was developed and can be downloaded from the NDS web page.

**V. Zerkin** demonstrated X4Plot – a universal web plotting tool where users can select and group columns for the horizontal and vertical axis, and showed that group-wise data can be plotted not by a symbol with horizontal error bar but by a histogram. He also demonstrated EXFOR search by an author using aliases (*e.g.*, Tokarevski, Tokarevskii, Tokarevskij, Tokarevskiy or Tokarevsky) registered in an internal dictionary (Dictionary 349) where 820 names from 358 groups are tabulated, and suggested other centres to provide more groups for further improvement.

**V. Zerkin** also reported that he started preparation of covariance information following the new covariance format. During this work, he recognized the following two problems: 1) correlation between the 0-th coefficient and  $i$ -th ( $i = 1, 2, \dots$ ) coefficient compiled in two different subentries, 2) standard deviation which is coded remotely in the DATA section in the new covariance format.

## 2.10 Other Business

**N. Takibayev** introduced the Central Asian Nuclear Reaction Database (CANRDB) which was launched in 2013 at al-Farabi Kazakh National University. He explained that the main tasks of CANRDB are (1) compilation of experimental data from Central Asia to EXFOR and (2) development of the system for access to the database and education materials related to nuclear physics.

**N. Kenzhebeyev** reported that the 4<sup>th</sup> Asian Nuclear Reaction Database Workshop was held in Almaty in October 2013, and the proceedings were published as the report INDC(KAS)-0001. He also reported that 9 EXFOR entries including 21 data sets measured in Almaty and Tashkent have been compiled by his group since October 2013.

**S. Simakov** summarised the recent progress in compilation of experimental data related to the safeguards application (neutron multiplicity distribution, cross sections for nuclear resonance fluorescence). He informed participants about the importance and relevance to safeguards application - antineutrino spectra. Such spectra were measured directly or were obtained from experimental beta spectra for neutron induced fission of  $^{235,238}\text{U}$  and  $^{239,241}\text{Pu}$  isotopes. Information is available (mainly in tabulated form) in 8 articles. He proposed to extend the current EXFOR compilation scope by including such decay particle spectra. He also reported about novel experiments which use the internal conversion electrons technique to measure reaction cross sections or natural decay of actinides.

**S. Simakov** also introduced the recent discussion on  $^{16}\text{O}(n,\alpha)^{13}\text{C}$  and  $^{13}\text{C}(\alpha,n)^{16}\text{O}$  cross sections in the framework of the Collaborative International Evaluated Library Organisation (CIELO, currently coordinated by NEA WPEG SG-40). He expressed a view that the CIELO project will essentially rely on the existing experimental data already available in EXFOR. Involvement of NRDC in this project will result in the further improvement of the relevant EXFOR entries. He suggested implementing calculation of the inverse reaction cross section by use of detailed balance principle in EXFOR retrieval systems.

**B. Pritychenko** noted that the CIELO project reviews existing major nuclear data libraries and studies the discrepancies among the libraries as well as integral properties for high-priority target isotopes ( $^1\text{H}$ ,  $^{16}\text{O}$ ,  $^{56}\text{Fe}$ ,  $^{235,238}\text{U}$ , and  $^{239}\text{Pu}$ ). He reported that there are experimental works for which the compilers could not receive numerical data from the authors and entries are created without numerical data, and he argued addition of numerical data by digitization must be done. The participants agreed to eliminate such entries for neutron-induced reaction data with the above

mentioned six target isotopes. He also mentioned that he recognizes lack of covariance and double differential data in EXFOR is disturbing users.

## **2.11 Closing**

**N. Otsuka** proposed the dates and places for the next technical NRDC meeting (Vienna, Austria, 21 to 23 April 2015) and next full NRDC meeting (Brookhaven, USA or Vienna, Austria in the 2<sup>nd</sup> quarter of 2016), and they were approved.

**V. Semkova** noted that the next EXFOR Compilation Workshop will be held in Vienna, Austria from 6 to 10 October 2014, and mentioned that she expects presentations by the workshop participants.

The participants reviewed the conclusions and actions.

**R. Forrest** congratulated the meeting participants on good progress in compilation, new possibilities for interacting with EXFOR database including evaluations and theoretical calculations and software tools for digitization and editing. He asked the participants to use the Feedback and other lists to ensure that they fulfil their responsibilities, and also to consider possible changes to working such as the impact of new formats. He thanked E. Dupont for his excellent management of the meeting as Chairman, and also S. Hlaváč for the wonderful location and organisation of the meeting as well as the memorable excursion to the modern power plant and medieval city provided by him and his team.



## LIST OF PARTICIPANTS

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## AGENDA

Tuesday, 6 May 2014

## Plenary: 9:30 – 13:00

**1. Opening Items**

1.1	Welcome address	10 min		S. Hlaváč
1.2	Introduction from NDS	10 min		R.A. Forrest
1.3	Self-introduction	15 min		All
1.4	Election of chairperson, adoption of the agenda, announcements	5 min		N. Otsuka

**2. Progress Reports**

2.1	NDPCI (Mumbai, India)	10 min	P2014-01	A. Saxena
2.2	CNPD (Sarov, Russia)	10 min	P2014-02	S. Taova
2.3	ATOMKI (Debrecen, Hungary)	10 min	P2014-03	F. Tárkányi
2.4	JAEA (Tokai, Japan)	10 min	P2014-04	O. Iwamoto
2.5	CNDC (Beijing, China)	10 min	P2014-05	Ge Zhigang
2.6	NDS (Vienna, Austria)	10 min	P2014-06	R. Forrest
2.7	CJD (Obninsk, Russia)	10 min	P2014-07	M. Mikhaylyukova
2.8	NEA DB (Paris, France)	10 min	P2014-08	K. Matsumoto
2.9	JCPRG (Sapporo, Japan)	10 min	P2014-09	M. Aikawa
2.10	CDFE (Moscow, Russia)	10 min	P2014-10	V. Varlamov
2.11	UkrNDC (Kyiv, Ukraine)	10 min	P2014-11	O. Gritzay
2.12	KNDC (Daejeon, Korea)	10 min	P2014-12	Y. O. Lee
2.13	NNDC (Upton, USA)	10 min	P2014-13	B. Pritychenko

*180 min*

## Plenary: 14:00 – 18:00

**3 EXFOR General**

3.1	Transmission statistics	10 min	WP2014-02	V. Semkova
3.2	Scanning of new publications	10 min	WP2014-03	V. Semkova
3.3	Preliminary tape checking by centres	10 min	WP2014-04	V. Semkova
3.4	Statistics of new article compilation (A1)	10 min	WP2014-05	N. Otsuka
3.5	Corrections of entries in feedback list (A6)	10 min	WP2014-06	N. Otsuka
3.6	Status of CAJaD and future compilation of data from former USSR	10 min	WP2014-07	N. Otsuka, S. Taova
3.7	Compilation of data measured in Kazakhstan and Uzbekistan	10 min	WP2014-07 WP2014-08	N. Otsuka

3.8	Other actions (A2-A5, A7-A10)	10 min	WP2014-01	Chairperson
<b>4</b>	<b>Manuals and Dictionary</b>			
4.1	Revised Network document (A11-A12)	10 min	WP2014-09	N. Otsuka
4.2	NDS open area and naming convention	10 min	WP2014-10	N. Otsuka
4.3	Revised NRDC Protocol (A13, A17)	10 min	WP2014-11	N. Otsuka
4.4	LEXFOR "Digitization" (A15)	10 min	WP2014-12	N. Otsuka
4.5	LEXFOR and Formats Manual on covariance	10 min	WP2014-13	N. Otsuka
4.6	Expansion of heading ERR-i; i=1,2,... (A25)	10 min	WP2014-14	N. Otsuka
4.7	Other actions(A14, A16, A18-A24)	10 min	WP2014-01	Chairperson
<b>5</b>	<b>CINDA</b>			
5.1	Status of CINDA database	10 min	WP2014-15	V. Zerkin
5.2	Other actions (A26-A27)	10 min	WP2014-01	Chairperson
<b>6</b>	<b>EXFOR Compilation Needs</b>			
6.1	Compilation of articles with a priority (A28, A30-A32, A34)	10 min	WP2014-16	V. Semkova
6.2	EXFOR data in resonance region and spectrometer's response function	10 min	WP2014-17	V. Semkova
6.3	Monitor reactions and medical isotope production reactions (A33)	10 min	WP2014-18	N. Otsuka
6.4	EXFOR completeness for articles cited in Mughabghab's Atlas (A35-A36)	10 min	WP2014-19	N. Otsuka
6.5	EXFOR completeness for articles cited in NACRE II article	10 min	WP2014-20	N. Otsuka

210 min

### Wednesday, 7 May 2014

#### Plenary: 9:00 – 13:00

<b>6</b>	<b>EXFOR Compilation Needs (cont)</b>			
6.6	The IAEA CRP on IRDFF validation and EXFOR	15 min	WP2014-21	S. Simakov
6.7	EXFOR completeness checking against IBANDL	10 min	WP2014-22	V. Semkova
6.8	Delayed neutron energy spectrum from a specific precursor	20 min	WP2014-23	V. Semkova

6.9	Other actions (A29, A37)	10 min	WP2014-01	Chairperson
<b>7</b>	<b>EXFOR Quality Control</b>			
7.1	Corrections requested in the last meetings (A38-A39, A44-A46)	10 min	WP2014-24	N. Otsuka
7.2	Duplication created from the same reference (A40-A42)	10 min	WP2014-25	N. Otsuka
7.3	Duplication in isotope production cross sections by Michel's group	10 min	WP2014-26	N. Otsuka
7.4	English translation of ZET and ZEP	10 min	WP2014-27	N. Otsuka
7.5	English translation of DOK	10 min	WP2014-28	N. Otsuka
7.6	English translation of IZV (A47)	10 min	WP2014-29	N. Otsuka
7.7	JANIS Import Log (A50-A51)	10 min	WP2014-30	N. Otsuka
7.8	NODATA+UNOBT entries (A53)	10 min	WP2014-31	N. Otsuka
7.9.	EXFOR Updates and Archives: database and Web access	20 min	WP2014-32	V. Zerkin
7.10	Free EXFOR entry numbers	10 min	WP2014-33	M. Mikhaylyukova
7.11	Other actions (A43, A48-A49, A52)	10 min	WP2014-01	Chairperson

*175 min*

### **Plenary: 14:00 – 18:00**

<b>8</b>	<b>EXFOR Coding Rule</b>			
8.1	Usage of Heading THICKNESS	10 min	WP2014-34	N. Otsuka
8.2	Discovering repetition of values of independent variables in EXFOR data library (A71)	10 min	WP2014-35	V. Zerkin
8.3	LEXFOR "Neutron yields"	10 min	WP2014-36	N. Otsuka
8.4	LEXFOR "Fission yields" and related dictionary additions	10 min	WP2014-37	N. Otsuka
8.5	LEXFOR "Thermonuclear reaction rate"	10 min	WP2014-38	N. Otsuka
8.6	Excitation energy for inclusive reaction	10 min	WP2014-39	N. Otsuka
8.7	Coding of articles form ND2013 conference	10 min	WP2014-40	S. Hlaváč N. Otsuka
8.8	Beta-delayed neutron emission probability and multiplicity	10 min	WP2014-41	V. Semkova
8.9	HISTORY coding	10 min	WP2014-42	O. Schwerer
8.10	Addition to LEXFOR entry on partial reactions	10 min	WP2014-43	O. Schwerer
8.11	Addition to dictionary 24 and LEXFOR: Heading TKE	10 min	WP2014-44	O. Schwerer
8.12	Data sets coded with RNORM or RCALC under STATUS	10 min	WP2014-45	N. Otsuka

8.13	Compilation of data corrected or derived by other than author	60 min	WP2014-46	N. Otsuka O. Schwerer
8.14	Other actions (A54-A55)	10 min	WP2014-01	Chairperson

*190 min*

## Thursday, 8 May 2014

### Plenary: 9:00 – 13:00

#### 9 Software and Dissemination

9.1	New version of InpGraph - structure and service (A75)	10 min	WP2014-47	G. Pikulina
9.2	Evaluation of digitization error	20 min	WP2014-48	S. Taova
9.3	Introduction to GDgraph	10 min		G.C. Chen
9.4	Results of development and testing of the EXFOR-Editor (A75)	10 min	WP2014-49	G. Pikulina
9.5	Integration of the X4+ Converter Code into the EXFOR-Editor (A66)	10 min	WP2014-50	G. Pikulina
9.6	Japanese compilation tools (A72-A73)	15 min	WP2014-51	M. Aikawa
9.7	X4Plot: Universal plotting of EXFOR data with arbitrary selection and grouping columns	15 min	WP2014-52	V. Zerkin
9.8	EXFOR search by author using aliases	10 min	WP2014-53	V. Zerkin
9.9	Coding of covariance data for all EXFOR Entries having authors' covariance (A70)	10 min	WP2014-54	V. Zerkin
9.10	Development of EXFOR-XML (Ver-2, information from WPEC-38)	10 min		V. Zerkin
9.11	IBANDL maintenance system and new Web interface	10 min		V. Zerkin
9.12	Development of Web Server Calculations EXFOR, ENDF, EMPIRE, GND-XML	5 min		V. Zerkin
9.13	Portable Empire-3.2.2 for Windows	5 min		V. Zerkin
9.14	Other actions (A56-A65, A67-A69, A74, A76)			

*140 min*

### 14:00 – Social event (Jaslovské Bohunice, Trnava, Dinner)



## Friday, 9 May 2014

### Plenary: 9:00 – 12:00

#### 10 Other Business

10.1	Central Asian Nuclear Reaction Database (CA-NRDB)	15 min	WP2014-55	N. Takibayev
10.2	Compilation of data measured in Kazakhstan and Uzbekistan	15 min	WP2014-56	N. Kenzhebayev
10.3	EXFOR innovative nuclear data: response to safeguards needs and new measuring techniques	15 min		S. Simakov
10.4	EXFOR for CIELO project: $^{16}\text{O}(n,\alpha)$ and $^{13}\text{C}(\alpha,n)$ data	15 min		S. Simakov
10.5	Experimental nuclear reaction data compilation and other needs of CIELO project	15 min		B. Pritychenko
10.6	Other business	10 min		

#### 11 Closing

11.1	Date and place of next meeting	5 min		N. Otsuka
11.2	EXFOR Compilation Workshop	10 min		V. Semkova
11.3	Review of actions and conclusions	60 min		Chairperson
11.4	Adjournment	5 min		R. Forrest

*120 min*



## CONCLUSIONS AND ACTIONS

### Conclusions

#### General

- C1 The next technical NRDC meeting will be held in Vienna, Austria from 21 to 23 April 2015.
- C2 The next full NRDC meeting will be held in Brookhaven, USA or Vienna, Austria in the 2<sup>nd</sup> quarter of 2016.

#### EXFOR General

- C3 The next EXFOR Compilation Workshop will be held in Vienna, Austria from 6 to 10 October 2014.
- C4 CAJaD discontinued. The participants appreciated the contribution of CAJaD to the NRDC activity for about 40 years.
- C5 From May 2014, CNPD will be responsible for charged-particle nuclear reaction data measured in the countries of the former USSR (except for Ukraine) and also maintenance of the area A and F entries. NDS will be responsible for maintenance of the area B entries.
- C6 The neutron, charged-particle and photonuclear data measured in Kazakhstan and Uzbekistan will be compiled by the Central Asian group (coordinated by Kazakh National University) with assistance of NDS for a trial period.
- C7 Data Centres should put higher priority to correction of mistakes reported by EXFOR users than other mistakes.
- C8 Compilers will inform Semkova when they find an article published in conference proceedings and the numerical data are not available from the author.
- C9 Participants were informed about the existence of tabulated experimental nuclear data related to the various innovative nuclear techniques (*e.g.*, detection of internal conversion electrons and anti-neutrinos), and some of them (*e.g.*, nuclear resonance fluorescence, neutron multiplicity distribution) are being compiled in EXFOR.

#### Manuals and Dictionaries

- C10 The revised Network Document (WP2014-09) was approved.

- C11 The new transmission procedure and file naming convention related to the new NDS open area (WP2014-10) was approved.
- C12 The revised NRDC Protocol (WP2014-11) was approved.  
N.B. EPJ/A and YF will be added as journals scanned by CNPD in Appendix B (scanning responsibility) of the NRDC Protocol.
- C13 The new LEXFOR chapter “Digitization” (WP2014-12) was approved.
- C14 Revisions of LEXFOR and Formats Manual on covariance (WP2014-13) were approved.
- C15 Change in the expansions of the data heading  $ERR-i$  ( $i = 1,2,\dots$ ) and the usage of two headings  $ERR-S$  and  $ERR-SYS$  (WP2014-14) were approved.

### **CINDA**

- C16 The CINDA Master File is updated from the EXFOR and NSR database in an automatic way by NDS, and regularly transmitted to other centres.

### **EXFOR Compilation Needs**

- C17 Compilers are encouraged to request the author to provide required information by using the EXFOR template for time-of-flight spectra or lead slowing-down spectrometer data (Appendices of INDC(NDS)-0647), and include the information in the EXFOR entry.
- C18 The revised LEXFOR chapter “Delayed-fission neutrons” (CP-C/429 in WP2014-23 Rev. and WP2014-41 Rev.) was approved. The delayed neutron energy spectrum from an individual precursor may be compiled in EXFOR.
- C19 Compilers are encouraged to find data published in old literature and still missing in EXFOR.

### **EXFOR Quality Control**

- C20 Centres should use only new entry numbers (and not old “unallocated” entry numbers).

### **EXFOR Coding Rule**

- C21 The revised LEXFOR chapter “Sample” (WP2014-34) was approved. The sample thickness will be coded under the data heading  $THICKNESS$  if the quantity depends on the sample thickness (*e.g.*, transmission, reaction yield). Also this heading will not be used if the quantity does not depend on the thickness (*e.g.*, cross section).

- C22 A list of data sets where repetition of values exists is available on the NDS web page (WP2014-35).
- C23 The revised LEXFOR chapter “Neutron yields” (WP2014-36) was approved. NDS confirmed that all subentries listed in the working paper have already been corrected. See also Action 68 to Lee.
- C24 The revised LEXFOR chapter “Fission yields” and related dictionary additions (WP2014-37 and WP2014-44) were approved.
- C25 The revised LEXFOR chapter “Thermonuclear reaction rate” (WP2014-38) was approved. This quantity will be coded without the spectrum modifier  $_{MXW}$ .
- C26 The revised LEXFOR chapter “Production and emission cross sections” (WP2014-39) was approved. The new branch code  $_{ICL}$  will be used when a data set is for an inclusive reaction and also depends on the excitation energy.
- C27 The articles presented in ND2013 will be coded by  $(J,NDS,,(\$paper\ #),2014)$  before publication of the Conf. Proc. A new conference code  $2013NYC$  will be used for the data published in an abstract but not in the Conf. Proc.
- C28 The revised LEXFOR chapter “History” (WP2014-42) was approved. All important alterations must be described in each affected data subentry in addition to a short summary (*e.g.*, subentry numbers) in the common (001) subentry.
- C29 The revised LEXFOR chapter “Partial reactions” (WP2014-43) was approved.
- C30 The following decisions were made for data sets corrected or derived by other than the author (WP2014-46): (1) Compilation of data sets renormalized by other than the author is not recommended. (2) Data sets corrected by other than the author should be compiled in another entry when the corrected data are well documented in a peer-reviewed journal with the correction procedure. (3) Data sets derived by other than the author are not for compilation in general, but may be compiled in another entry exceptionally when there is a strong need from EXFOR users and the derived data are well documented in a peer-reviewed journal with the derivation procedure.

## Software and Dissemination

- C31 The digitization error estimated by two methods (“standard derivation” and “quantization error”) presented in WP2014-48 are consistent if we introduce a factor 1/2 to the definition of the “quantization error”. This implies that both estimates are reasonable (when quantization is the main source of the digitization error).

## Actions

### EXFOR General

- A1 All (Standing action) Give the highest priority to compilation of new articles.
- A2 Semkova (Continuing action) Introduce a flag to the EXFOR Compilation Control System to indicate articles which are published in conference proceedings and the data are not available from the authors.
- A3 Semkova (Continuing action) Add the first author name to the EXFOR Compilation Control System as time permits.
- A4 All (Continuing action) Correct erroneous entries listed on the EXFOR Feedback System on the NRDC web page according to the indicated priorities. All urgent corrections must be done by the next meeting.
- A5 Centre Heads (Continuing action) Nominate participants from the Centres to the EXFOR working group coordinated by Zerkin, which will discuss the opportunity to use XML as a new exchange format.
- A6 Otsuka  
Semkova (Continuing action) Prepare a questionnaire about the usages of compilation tools, and send it to centres.
- A7 All (Continuing action) Respond to the questionnaire mentioned above.

### Manuals and Dictionaries

- A8 Otsuka  
Schwerer Submit an update of LEXFOR for data corrected or derived by other than author (c.f. WP2014-46).
- A9 Otsuka Change “systematic” to “partial” in the expansions of the data heading code  $ERR-i$  ( $i = 1,2,\dots$ ) in dictionary 24 (WP2014-14).
- A10 Otsuka Add the heading code  $TKE$  (total kinetic energy) to dictionary 24 (WP2014-44).
- A11 Otsuka (Continuing action) Revise the EXFOR Formats Manual for (a) short nuclide codes in  $REACTION$  SF7 (WP2011-28); (b) the keyword  $ERR-ANALYS$  (Conclusion 15 of NRDC 2012); (c) the keyword  $SAMPLE$  (Conclusion 17 of NRDC 2012); (d) reaction products (WP2013-24); (e) covariance (WP2014-13).

- A12 Otsuka Delete the following footnote in the LEXFOR entry “History”:  
Compilers are urged to document all changes under HISTORY.
- A13 Otsuka (Continuing action) Revise LEXFOR for (a) TOF covariance (WP2011-27); (b) new branch code `ISP` (WP2011-29); (c) specific temperatures for prompt fission neutron spectrum averaged quantities (WP2011-30); (d) compilation of prompt fission neutron quantities (WP2011-31); (e) nuclear resonance fluorescence (WP2012-11); (f) additional reference compiled in another entry (WP2012-12); (g) probability for  $N$  particle emission (WP2013-20); (h) heading of energy range for unresolved resonance parameters (WP2013-21); (i) resonance parameters for light-nuclei reaction (WP2013-24); (j) partial reaction, reaction product, isomeric state (WP2013-25=CP-D/781rev + CP-C/417 item 3); (k) independent and cumulative data (WP2013-26); (l) irradiation time (WP2013-27); (m) thick target production yield (WP2013-28); (n) digitization (WP2014-12); Covariance (WP2014-13); (o) delayed fission neutron spectrum (WP2014-23 Rev.); (p) sample (WP2014-34); (q) neutron yields (WP2014-36); (r) fission yields (WP2014-37 and 44); (s) thermonuclear reaction rate (WP2014-38); (t) production and emission cross sections (WP2014-39); (u) delayed fission neutrons (WP2014-41 Rev.); (v) history (WP2014-42); (w) partial reactions (WP2014-43).
- A14 Otsuka Assess required corrections in dictionaries in order to treat the sample thickness as an independent variable (WP2014-34).
- A15 Otsuka (Continuing action) Consider revision of the NRDC Protocol for submission of transmission tapes specialized for corrections.
- A16 Otsuka (Continuing action) Update Dictionaries every four months.

## CINDA

- A17 Zerkin Correct EXFOR entry numbers in CINDA: `4,EXFOR13906` → `4,EXFOR14016`; `4,EXFOR32505` → `4,EXFOR31504`; `4,EXFOR42423` → `4,EXFOR41423`.
- A18 Zerkin Document export from NSR to CINDA especially for information missing in NSR and required in CINDA.
- A19 Zerkin (Continuing action) Export EXFOR and NSR to CINDA, and distribute it to other Centres every 6 months.

## EXFOR Compilation Needs

- A20 Aikawa (Continuing action) Compile the neutron source spectra listed in  
Chen CP-D/700 (Rev.3).  
Pritychenko  
Taova
- A21 Aikawa (Continuing action) Compile the proton-induced isotope  
Dupont production cross sections listed in CP-D/725 (=WP2012-19) with  
Pritychenko higher priority for articles listed in CP-D/793 (=WP2014-18).  
Takács Notify Semkova if the assigned centre does not compile the high  
Taova energy ( $E > 1$  GeV) data in the list.
- A22 Aikawa (Continuing action) Compile the light charged-particle induced  
Dupont isotope production cross sections listed in CP-D/757 (=WP2013-  
Otsuka 12) with a high priority for articles listed in CP-D/793  
Pritychenko (=WP2013-18). Notify Semkova if the assigned centre does not  
Taova compile the high energy ( $E > 1$  GeV) data in the list.
- A23 Chen Compile the articles cited in the NACRE II (an update and  
Dupont extension of European Compilation of Reaction Rates for  
Otsuka Astrophysics) listed in Tables 1 and 2 of CP-D/833 (=WP2014-  
Pritychenko 20).  
Takács  
Taova  
Varlamov  
Yang
- A24 Aikawa Compile the articles related to ion beam analysis application  
Chen listed in CP-D/832 Rev. (=WP2014-22).  
Dupont  
Gritzay  
Semkova  
Pritychenko
- A25 Otsuka Compile the articles listed in the last page of WP2014-33  
Pritychenko (articles compiled in CINDA but missing in EXFOR).  
  
N.B. The CINDA record for EXFOR 13906 is corresponding to  
the EXFOR entry 14016, and additional compilation is not  
necessary.
- A26 Dupont Compile the  $\beta$ -delayed neutron spectra published in the articles  
Pritychenko listed in the table of CP-D/837 (in WP2014-23 Rev.).
- A27 Pritychenko Compile articles related to the neutron dosimetry cross sections  
listed in the second table of CP-D/838 (=WP2014-21).



- A28 Dupont  
Mikhaylyukova  
Pritychenko  
Semkova Compile the thermal neutron-induced reaction data cited in Mughabghab's "Atlas of Neutron Resonances" and listed in 4C-3/395 (=WP2014-19).
- A29 Dupont  
Pritychenko (Continuing action) Assess the articles reporting keV neutron capture cross section entries listed in WP2012-31, and add these articles with necessary revisions.
- A30 Pritychenko (Continuing action) Assess neutron cross section data useful for standard evaluation listed in WP2011-15, and compile them when appropriate.
- N.B. Renner's thesis on  ${}^6\text{Li}(n,\alpha)$  is for addition to 10841.
- A31 Mikhaylyukova Check if  ${}^{252}\text{Cf}$  (s.f.) prompt fission neutron spectrum published in the following article must be compiled: Yu.S. Zamyatnin et al., Proc. Int. Symp. on Californium-252 Utilizations, Paris (1976) p. IV-1 (= CONF-760436, Vol. II).
- A32 Dupont  
Mikhaylyukova  
Pritychenko (Continuing action) Perform EXFOR completeness checking for the list of articles received from NDS (articles cited in S. Mughabghab's "Atlas of Neutron Resonances") to identify articles missing in EXFOR, and assign responsibility of compilation of the identified articles to centres for by a memo.
- A33 Otsuka Perform EXFOR completeness checking for the articles published in the conference proceedings in the past Symposia on Reactor Dosimetry (WP2014-21).
- A34 Kenzebayev Scan domestic publications (*e.g.*, journals, laboratory reports) to identify articles for EXFOR compilation.
- A35 Gritzay (Continuing action) Consider compilation of neutron spectra for filtered neutrons published in the last 10 years.
- A36 Pritychenko Establish a mechanism with ORNL to receive the time-of-flight spectra (transmission and reaction yield) measured at ORELA for inclusion to EXFOR.
- A37 Dupont  
Simakov Monitor CIELO mailing lists, and try to receive tabulated experimental data from evaluators who have their own internal database.
- A38 Dupont  
Simakov Assess whether the experimental spectrum averaged cross sections available in the SINBAD and ICSBEP databases are suitable for inclusion in EXFOR.

## EXFOR Quality Control

- A39 Otsuka Delete B0116 to resolve intra-centre duplication (c.f. CP-D/751).
- A40 Dupont  
Otsuka  
Pritychenko  
Taova (Continuing action) Resolve inter-centre duplication listed in CP-D/762 (= first table of WP2014-25), and inform Otsuka about the conclusion.
- A41 Dupont  
Taova (Continuing action) Resolve the duplication pairs in entries listed in Memo CP-D/797 (=second table of WP2014-25).
- A42 Dupont  
Taova Resolve duplication of Michel's proton-induced reaction cross section data sets as summarized in Memo CP-D/805 (see also first table of WP2014-26).
- A43 Taova Delete Michel's alpha-induced reaction cross section data sets compiled in A0145.004 and A0529.002-013 (See CP-D/805=WP2014-26).
- A44 Otsuka (Continuing action) Summarize the duplication pairs in the EXFOR entries listed in the item 3b of WP2013-17 (D-T neutron activation cross sections from OKTAVIAN, Osaka Univ.).
- A45 Mikhaylyukova (Continuing action) Add English translation information of Atomnaya Energiya under the keyword REFERENCE as listed in WP2011-26 (also registered to the EXFOR Feedback System).
- A46 Mikhaylyukova (Continuing action) Add English translation information of Yadernaya Fizika under the keyword REFERENCE as listed in WP2012-24 (also registered to the EXFOR Feedback System).
- A47 Mikhaylyukova  
Taova (Continuing action) Add English translation information of Yadernye Konstanty under the keyword REFERENCE as listed in Tables 1 and 2 of CP-D/777(=WP2013-15, also registered to the EXFOR Feedback System).
- A48 Mikhaylyukova  
Taova Add English translation information of Zhurnal Eksp. Teoret. Fiziki (incl. Pis'ma v Redaktsiyu) under the keyword REFERENCE as listed in CP-D/809 (=WP2014-27, also registered to the EXFOR Feedback System).
- A49 Dupont  
Mikhaylyukova  
Taova  
Varlamov Add English translation information of Doklady Akademii Nauk under the keyword REFERENCE as listed in CP-D/842 (=WP2014-28, also registered to the EXFOR Feedback System).

- A50 Taova  
Varlamov Identify the bibliographies of the original Russian article published in Doklady for EXFOR 41257 and 41258, and notify them to Mikhaylyukova and Otsuka.
- A51 Otsuka (Continuing action) Provide a list of English translation information of Izvestiya Rossiiskoi Akademii Nauk, Seriya Fizicheskaya for addition to EXFOR entries.
- A52 Dupont  
Mikhaylyukova  
Otsuka  
Pritychenko  
Taova  
Varlamov Add English translation information of Izvestiya Rossiiskoi Akademii Nauk, Seriya Fizicheskaya under the keyword REFERENCE following the list prepared by Otsuka (A51).
- A53 Mikhaylyukova  
Pritychenko Look for the original data for the entries flagged by 1 in the table of WP2014-45. If the original data are no longer available, consider using free text instead of RNORM.
- A54 Dupont  
Mikhaylyukova  
Otsuka Correct entries coded with RNORM and flagged by 2, 3 or 4 in the table of CP-D/841 Rev.(=WP2014-45, also registered to the EXFOR Feedback System.)
- A55 Dupont  
Mikhaylyukova  
Otsuka  
Taova Assess the entries listed in Appendix C of WP2014-32. Re-compile the article based on the entry in the NDS EXFOR Archive and Update system when appropriate. If not, create only the common subentry with minimum keywords (*i.e.*, TITLE, AUTHOR, REFERENCE, FACILITY, HISTORY) as time permits.
- A56 Dupont  
Mikhaylyukova  
Pritychenko Try to add numerical data which are not superseded (SPSDD) but still unobtainable (UNOBT) for neutron-induced reaction data published in old literature for  $^1\text{H}$ ,  $^{16}\text{O}$ ,  $^{56}\text{Fe}$ ,  $^{235}\text{U}$ ,  $^{238}\text{U}$  and  $^{239}\text{Pu}$ .
- A57 Taova (Continuing action) Correct F0004.002 and 003 which are partial for secondary energies listed in CP-D/718 (=WP2012-22, also registered to the EXFOR Feedback System).
- A58 Dupont  
Pritychenko Correct inclusive reaction data coded as a function of the excitation energy listed in the last page of CP-D/813 Rev.2 (=WP2014-39, also registered to the EXFOR Feedback System.).
- A59 Lalremruata Compare  $^{13}\text{C}(\alpha,n)^{16}\text{O}$  data compiled in EXFOR D6089 and P0132, and make necessary corrections.
- A60 Semkova Check existing EXFOR data sets coded with ,PN against the original articles, and summarize the necessary corrections due to the new coding rule summarized in WP2014-41 Rev.

- A61 Dupont (Continuing action) Provide NDS with a list of erroneous and suspicious outliers by using the new statistical approach being developed (WP2011-17, WP2013-19) when available.
- A62 Dupont (Continuing action) Provide JANIS–TRANS Checker Log list on every preliminary TRANS-file.
- A63 Soppera (Continuing action) Provide JANIS Import Log created from the EXFOR Master File to Otsuka on a regular basis.
- A64 Otsuka (Continuing action) Assess the JANIS Import Log provided by Soppera as above, and register important errors to the EXFOR Feedback System.
- A65 All (Continuing action) Revise remaining upper case entries and other necessary corrections as time permits (WP2012-20).
- A66 All Search TRANS tapes missing in the NDS open area, and provide them to NDS.

### **EXFOR Coding Rule**

- A67 Otsuka Send articles relevant to the change in the definition of the  $\eta$  value (WP2014-36) to Lee.
- A68 Lee Assess the articles received from Otsuka and check if the new definition of the  $\eta$  value proposed in WP2014-36 requires modifications.

### **Software and Dissemination**

- A69 Dupont (Continuing action) Provide a sample file of quality scores (WP2013-19) to Zerkin.
- A70 Zerkin Dupont (Continuing action) Assess procedure for inclusion of the quality scores mentioned above to regular distribution with the EXFOR Master File.
- A71 Otsuka (Continuing action) Provide EXFOR News for every EXFOR Master File.
- A72 Soppera (Continuing action) Continue development and testing of the JANIS –TRANS Checker in cooperation with NDS and the other centres.
- A73 Zerkin Simakov Assess possibility to provide cross sections derived from the measured cross sections by the detailed-balance relation, and to add the functionality to the NDS web system.

- A74 Zerkin (Continuing action) Update ZCHEX based on comments from compilers (*e.g.*, WP2011-36) as time permits.
- A75 All (Continuing action) Provide feedback to NDS on the existing ZCHEX version (on bugs as well as desired additions.). Bugs must be reported with sample entries which are checked and not checked properly by ZCHEX.
- A76 Zerkin (Continuing Action) Prepare coding of covariance data for all EXFOR Entries having authors' covariances, and offer them to Data Centres according to Areas for finalizing and submitting to the database.
- A77 Zerkin (Continuing action) Continue development of the EXFOR upload web tool.
- A78 Zerkin (Continuing action) Every four months produce an EXFOR distribution with (a) full Dictionary distribution; (b) EXFOR in C4 and XC4 format; (c) Dictionaries in MS Access; (d) X4Map.
- A79 Zerkin (Continuing action) Continue development of X4+ (interpreted / extended EXFOR format).
- A80 All (Continuing action) Consider to use the X4+ format for author approval, and also send feedback to Zerkin.
- A81 Zerkin (Continuing action) Update and distribute the program package including a standalone platform independent program to generate X4+ from a standalone EXFOR entry.
- A82 Zerkin (Continuing action) Continue development of a new database encompassing correction factors and relevant comments for suspect/erroneous data (X4-evaluated) presented in WP2010-19; keep NRDC informed about conclusions of discussions on new database.
- A83 All Provide Zerkin a list of name aliases to improve the search of EXFOR entries by the author name (WP2014-53).
- A84 Zerkin (Continuing action) Assess possibility of translation from Pritychenko EXFOR to NSR.
- A85 JCPRG (Continuing Action) Continue development and testing of GSYS in cooperation with NDS and other centres, taking into account compilers' remarks.
- A86 All (Continuing Action) Provide JCPRG feedback on GSYS.

- A87 Otsuka Support update of the Japanese editor (HENDEL) as time permits.
- A88 CNPD (Continuing Action) Continue development and testing of the EXFOR-Editor and InpGraph in cooperation with NDS and other data Centres, taking into account compilers' remarks.
- A89 All (Continuing Action) Provide CNPD feedback on EXFOR-Editor and InpGraph.

## LIST OF PROGRESS REPORTS

Number	Title	Presented by
<a href="#">P2014-01</a>	A brief status update on the activities of Nuclear Data Physics Centre of India (NDPCI) during 2012-2014	A. Saxena
<a href="#">P2014-02</a>	Center of Nuclear Physics Data (CNPD), RFNC-VNIIEF	S. Taova
<a href="#">P2014-03</a>	Progress report: Nuclear Reaction Data Group at ATOMKI (2012-2014)	F. Tárkányi
<a href="#">P2014-04</a>	Progress report of Nuclear Data Center of Japan Atomic Energy Agency for April 2013 – March 2014	O. Iwamoto
<a href="#">P2014-05</a>	2013/14 status report of China Nuclear Data Center	Ge Zhigang
<a href="#">P2014-06</a>	IAEA Nuclear Data Section: Progress report for period 2013/14	R.A. Forrest
<a href="#">P2014-07</a>	CJD progress report	M. Mikhaylyukova
<a href="#">P2014-08</a>	NEA Data Bank progress report 2013-2014	K. Matsumoto E. Dupont
<a href="#">P2014-09</a>	Hokkaido University Nuclear Reaction Data Centre (JCPRG) progress report	M. Aikawa
<a href="#">P2014-10</a>	The CDFE progress report on new photonuclear data compilations and old data corrections for 2013 - 2014	V.V. Varlamov
<a href="#">P2014-11</a>	Ukrainian Nuclear Data Centre progress report, 2012/13	O. Gritzay

Note: These progress reports are available online: [http://www-nds.iaea.org/nrdc/nrdc\\_2014/](http://www-nds.iaea.org/nrdc/nrdc_2014/).





## LIST OF WORKING PAPERS

Number	Title	From
<a href="#">WP2014-01</a>	Conclusions and action of the 2013 NRDC Meeting	
<a href="#">WP2014-02</a>	New and revised entries / subentries since the 2013 NRDC meeting	V. Semkova
<a href="#">WP2014-03</a>	Scanning of new publications by NDS	V. Semkova
<a href="#">WP2014-04</a>	Preliminary tape checking by centres	V. Semkova
<a href="#">WP2014-05</a>	Statistics of new article compilation (A1)	N. Otsuka
<a href="#">WP2014-06</a>	Corrections of entries in feedback list (A6)	N. Otsuka
<a href="#">WP2014-07</a>	Status of CAJaD and future compilation of CPND from former USSR (CP-D/824)	N. Otsuka S. Taova
<a href="#">WP2014-08</a>	Compilation of data measured in Kazakhstan and Uzbekistan	N. Otsuka
<a href="#">WP2014-09</a>	Revised Network Document (A11-A12)	N. Otsuka
<a href="#">WP2014-10</a>	NDS Open Area and naming convention (CP-D/816)	N. Otsuka
<a href="#">WP2014-11</a>	Revised NRDC Protocol (A13,A17 CP-D/840)	N. Otsuka
<a href="#">WP2014-12</a>	LEXFOR entry "Digitization" (A15)	N. Otsuka
<a href="#">WP2014-13</a>	LEXFOR and Formats Manual on covariance (CP-C/428)	N. Otsuka
<a href="#">WP2014-14</a>	Expansion of heading ERR-i; i=1,2,... (A25, CP-D/843)	N. Otsuka
<a href="#">WP2014-15</a>	Status of CINDA database	V. Zerkin
<a href="#">WP2014-16</a>	Compilation of articles with a priority (A28,A30-A32,A34)	V. Semkova
<a href="#">WP2014-17</a>	EXFOR data in resonance region and spectrometer's response function	V. Semkova
<a href="#">WP2014-18</a>	Isotope production reaction data (A33 CP-D/793)	N. Otsuka
<a href="#">WP2014-19</a>	EXFOR completeness for articles cited in Mughabghab's Atlas (A35-A36 4C-3/395)	N. Otsuka

<a href="#">WP2014-20</a>	EXFOR completeness for articles cited in NACRE II article (CP-D/833)	N. Otsuka
<a href="#">WP2014-21</a>	The IAEA CRP on IRDFF validation and EXFOR (CP-D/838)	S. Simakov
<a href="#">WP2014-22</a>	EXFOR completeness for articles compiled in IBANDL (CP-D/832rev)	V. Semkova
<a href="#">WP2014-23 Rev.</a>	Delayed neutron energy spectrum from a specific precursor (CP-D/837, CP-C/429)	V. Semkova O. Schwerer
<a href="#">WP2014-24</a>	Corrections requested in the last meetings (A38-A39,A44-A46)	N. Otsuka
<a href="#">WP2014-25</a>	Duplication created from the same reference (A40-A42)	N. Otsuka
<a href="#">WP2014-26</a>	Duplication in proton activation cross sections measured by Michel's group (CP-D/805)	N. Otsuka
<a href="#">WP2014-27</a>	English translation of ZET and ZEP (CP-D/809)	N. Otsuka
<a href="#">WP2014-28</a>	English translation of DOK (CP-D/842)	N. Otsuka
<a href="#">WP2014-29</a>	English translation of IZV (A47)	N. Otsuka
<a href="#">WP2014-30</a>	Analysis of JANIS Import Log (A50-A51)	N. Otsuka
<a href="#">WP2014-31</a>	NODATA+UNOBT Entries (A53)	N. Otsuka
<a href="#">WP2014-32</a>	EXFOR Updates and Archives: database and Web access	V. Zerkin
<a href="#">WP2014-33</a>	Free EXFOR entry numbers (4C-4/207)	M. Mikhaylyukova
<a href="#">WP2014-34</a>	Usage of Heading THICKNESS (CP-D/808)	N. Otsuka
<a href="#">WP2014-35</a>	Discovering repetition of values of independent variables in EXFOR data library (A71)	V. Zerkin
<a href="#">WP2014-36</a>	LEXFOR "Neutron yields" (CP-D/798rev)	N. Otsuka
<a href="#">WP2014-37</a>	LEXFOR "Fission yields" and related dictionary additions (CP-D/807)	N. Otsuka
<a href="#">WP2014-38</a>	LEXFOR "Thermonuclear Reaction Rate" (CP-D/810)	N. Otsuka
<a href="#">WP2014-39</a>	Excitation Energy for Inclusive Reaction (SF3=X) (CP-D/813rev2)	N. Otsuka
<a href="#">WP2014-40</a>	Coding of articles form ND2013 conference (CP-C/418, CP-D/791)	S. Hlaváč N.Otsuka
<a href="#">WP2014-41 Rev.</a>	Beta-delayed neutron emission probability and multiplicity (4C-3/396, CP-C/429)	V. Semkova O. Schwerer
<a href="#">WP2014-42</a>	History coding (CP-C/424)	O. Schwerer
<a href="#">WP2014-43</a>	Addition to LEXFOR entry on partial reactions (CP-C/425)	O. Schwerer

<a href="#">WP2014-44</a>	Addition to dictionary 24 and LEXFOR: Heading TKE (CP-C/426)	O. Schwerer
<a href="#">WP2014-45</a>	Data set coded with RNORM or RCALC under STATUS (CP-D/841rev)	N. Otsuka
<a href="#">WP2014-46</a>	Compilation of data corrected or derived by other than author	N. Otsuka O. Schwerer
<a href="#">WP2014-47</a>	New versions of InpGraph - structure and service (A75)	G. Pikulina
<a href="#">WP2014-48</a>	New estimation of digitizing error in program InpGraph (CP-F/010)	S. Taova
<a href="#">WP2014-49</a>	Results of the EXFOR-Editor development and testing (A75)	G. Pikulina
<a href="#">WP2014-50</a>	Integration of the X4+ converter code into the EXFOR-Editor (A66)	G. Pikulina
<a href="#">WP2014-51</a>	Japanese compilation tools (A72-A73)	M. Aikawa
<a href="#">WP2014-52</a>	X4Plot: Universal plotting of EXFOR data with arbitrary selection and grouping columns	V. Zerkin
<a href="#">WP2014-53</a>	EXFOR search by author using aliases	V. Zerkin
<a href="#">WP2014-54</a>	Coding of covariance data for all EXFOR Entries having authors' covariance (A70)	V. Zerkin
<a href="#">WP2014-55</a>	Central Asian Nuclear Reaction Database (CA-NRDB)	N. Takibayev
<a href="#">WP2014-56</a>	Compilation of data measured in Kazakhstan and Uzbekistan	N. Kenzhebayev

Note: These working papers are available online: [http://www-nds.iaea.org/nrdc/nrdc\\_2014/](http://www-nds.iaea.org/nrdc/nrdc_2014/)



## LIST OF PRESENTATIONS

<b>TITLE</b>	<b>Presented by</b>
<a href="#">An Overview of activities of Nuclear Data Physics Centre of India 2012-2014</a>	A. Saxena
<a href="#">Center of Nuclear Physics Data</a>	S.M. Taova
<a href="#">Progress report: Nuclear Reaction Data Group at ATOMKI</a>	F. Tárkányi
<a href="#">Progress Report of Nuclear Data Center of Japan Atomic Energy Agency for April 2013 - March 2014</a>	O. Iwamoto
<a href="#">2013/14 status report of China Nuclear Data Center</a>	Ge Zhigang
<a href="#">Centre Report - IAEA NDS</a>	R.A. Forrest
<a href="#">Russian Nuclear Data Center (CJD, IPPE, Obninsk)</a>	M. Mikhaylyukova
<a href="#">NEA Data Bank (DB) progress report 2013-2014</a>	K. Matsumoto E. Dupont
<a href="#">JCPRG progress report</a>	M. Aikawa
<a href="#">Centre for Photonuclear Experiments Data</a>	V. Varlamov
<a href="#">Ukrainian Nuclear Data Centre progress report</a>	O. Gritzay
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<a href="#">Area #1 EXFOR report 2013</a>	B. Pritychenko
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<a href="#">EXFOR innovative nuclear data: response to safeguards needs and new measuring techniques</a>	S.P. Simakov
<a href="#">EXFOR for CIELO project: <math>^{16}\text{O}(n,\alpha)</math> and <math>^{13}\text{C}(\alpha,n)</math> data</a>	S.P. Simakov
<a href="#">Experimental nuclear reaction data compilation and other needs of CIELO project</a>	B. Pritychenko

Note: These presentations are available online: [http://www-nds.iaea.org/nrdc/nrdc\\_2014/](http://www-nds.iaea.org/nrdc/nrdc_2014/).

## COMPILATION RESPONSIBILITY

<u>Centre</u>	<u>Basic responsibility</u>	<u>Additional compilation</u>
NNDC	Neutron data, CPND and PhND from USA and Canada	
NEA DB	Neutron data from NEA Data Bank member countries (not covered by other centres)	CPND ( $A_{proj} \leq 12$ ) from NEA Data Bank member countries (not covered by other centres)
NDS	Neutron data and CPND from “rest of the world” (areas not covered otherwise)	PhND from “rest of the world”
CJD	Neutron data from former Soviet Union (except Ukraine)	
CDFE	Photonuclear data	
CNDC	Neutron data and CPND from China (entries submitted through NDS)	
JCPRG	CPND and PhND from Japan	CPND for projectiles with non-positive baryon number from all parts of the world.
JAEA	(Dissemination of Japanese Evaluated Data Libraries)	
ATOMKI	CPND from ATOMKI and data measured in cooperation with Jülich or with Free Univ. Brussels (entries submitted through NDS)	
UkrNDC	Neutron data, CPND and PhND from Ukraine (entries submitted through NDS)	
CNPD	CPND from former Soviet Union countries (except Ukraine)	CPND from the world (coordinated with other centres)
KNDC	Neutron data, CPND and PhND data from Korea (entries submitted through NDS)	
NDPCI	Neutron data, CPND and PhND from India, coordinated and assisted by NDS	







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