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# INDC International Nuclear Data Committee

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

IAEA Headquarters, Vienna, Austria

9 – 12 April 2019

Prepared by

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June 2019

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June 2019

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**Abstract**

This report summarizes the IAEA Technical Meeting on the International Network of Nuclear Reaction Data Centres held at the IAEA Headquarters in Vienna, Austria from 9 to 12 April 2019. The meeting was attended by 16 participants representing 12 cooperative Centres from eight Member States (China, Hungary, India, Japan, Korea, Russia, Ukraine and USA) and two International Organisations (NEA, IAEA) as well as a participant from Kazakhstan. A summary of the meeting is given in this report along with the conclusions and actions.



Technical Meeting on International Network of Nuclear Reaction Data Centres  
IAEA Headquarters, Vienna, Austria, 9 – 12 April 2019

from left to right

Viktor Zerkin, IAEA

Timur Zholdybayev, Kazakhstan

Galina Pikulina, Russian Federation

Wang Jimin, China

Sophiya Taova, Russian Federation

Sung-Chul Yang, Republic of Korea

Olena Gritzay, Ukraine

Tetsuaki Tada, Japan

Michael Fleming, NEA

Arjan Koning, IAEA

Naohiko Otsuka, IAEA

Jean-Christophe Sublet, IAEA

Shin Okumura, IAEA

Sandor Takács, Hungary

Marina Mikhailiukova, Russian Federation

Vladimir Varlamov, Russian Federation

Masaaki Kimura, Japan

Otto Schwerer, Austria

Vidya Devi, India

Joseph (Mark) Mawdsley, IAEA

Svetlana Dunaeva, Russian Federation

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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, Boulogne-Billancourt, 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

Vienna, 9-12 April 2019	Technical	INDC(NDS)-0792
Bahadurgarh, 1-4 May 2018	Centre Heads + Technical	INDC(NDS)-0762
Vienna, 23-26 May 2017	Technical	INDC(NDS)-0736
Beijing, 7-10 June 2016	Centre Heads + Technical	INDC(NDS)-0718
Vienna, 21-23 April 2015	Technical	INDC(NDS)-0686
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 + 13 <sup>th</sup> 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
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
MBDAV	Management Board for the Development, Application and Validation of Nuclear Data and Codes
NDS	IAEA Nuclear Data Section, Vienna, Austria
NEA	OECD Nuclear Energy Agency, Boulogne-Billancourt, France
NEA-DB	OECD/NEA Data Bank, Boulogne-Billancourt, 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
TALYS	A code system for prediction of nuclear reactions and generation of nuclear data
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 at the IAEA Headquarters in Vienna, Austria from 9 to 12 April 2019. The meeting was attended by 16 participants representing 12 cooperative Centres from eight Member States (China, Hungary, India, Japan, Korea, Russia, Ukraine and USA) and two International Organisations (NEA, IAEA) as well as a participant from (see **Appendix A**). Meetings of this network are held annually, with full meetings involving Centre Heads and technical staff every two years. (The last full meeting was held in May 2018 at the Global Centre for Nuclear Energy Partnership (GCNEP) in Bahadurgarh, Haryana, India.

Main topics of the present meeting were various statistics, manuals and dictionaries, compilation needs, quality control, coding rules as well as software and dissemination (see **Appendix B**). The results of the discussions were summarized in 27 conclusions and 78 actions (see **Appendix C**).

## 2. Brief Summary

### 2.1 Opening

**A. Koning**, Head of IAEA Nuclear Data Section welcomed the participants, and the participants introduced themselves. M. Fleming was elected as the chairperson, and the agenda was adopted.

### 2.2 Progress Reports

Progress reports from all 12 attending Centres were presented by **M. Mikhailiukova**, **V. Varlamov**, **T. Tada**, **S. Taova**, **O. Gritzay**, **A. Koning**, **S.C. Yang**, **S. Takács**, **V. Devi**, **M. Fleming**, **Wang Jiming** and **B. Pritychenko**, who highlighted the staffing, compilation, dissemination and other nuclear data related activities of interest to the network. See progress reports P2019-01 to P2019-11 (**Appendix D**) for further details.

### 2.3 EXFOR General

**N. Otsuka** presented the statistics of transmissions, journal scanning and preliminary tape checking. He reported that 448 new entries and 976 revised entries have been newly finalized since the last NRDC meeting.

**S. Okumura** reported that NDS regularly scans 40 journals since the last NRDC meeting. She emphasized that the journals in NRDC Protocol Appendix B (Scanning responsibility) and not regularly scanned by NDS must be scanned by other centres.

### 2.4 Manuals and Dictionaries

**M. Mikhailiukova** proposed a new LEXFOR chapter "Kerma factor", which was approved.

**N. Otsuka** proposed elimination of the sentence "*the institute determining the compilation responsibility is given first.*" from LEXFOR "Institute", and it was approved.

**N. Otsuka** demonstrated new web quantity dictionaries which relate the quantity name and REACTION SF3-SF8 (e.g., "Elastic scattering Rutherford ratio" → SF3=EL, SF6=DA and

SF8=RTH) to make EXFOR search for a specific quantity easier for those who are not familiar with the EXFOR rule, and performed demonstration using the JCPRG EXFOR web retrieval system (<http://www.jcprg.org/exfor/>).

## 2.5 CINDA

**V. Zerkin** reported that automatic updates of CINDA database using the EXFOR and NSR databases have been performed 8 times (from May 2018 to December 2018) after every update of NSR received from NNDC, and a MySQL dump of the complete CINDA database was sent to NNDC (USA), BARC (India), CNDC (China) and “Atomstandart” (Russia).

## 2.6 EXFOR Compilation Needs

**B. Pritychenko** reported the result of a cross-check between EXFOR and NSR for references containing fission yield data for spontaneous fission, photofission and neutron-induced fission. **S. Okumura** also reported the result of a cross check between EXFOR and citation lists of ENDF-B/VI (England and Rider) and UKFY3 (Mills) evaluation reports for references containing fission yield data. Participants agreed to put an action to centres for compilation of the fission product yield data identified as missing in EXFOR during these assessments.

**O. Gritzay** propose a new keyword SUPPL-INF (supplemental information) and coding rules under this keyword for accommodation of supplemental numerical data such as neutron source spectra and neutron detection resolution (response) functions, and they were approved.

## 2.7 EXFOR Quality Control

**V. Varlamov** reported that Vestnik Moskovskogo Universiteta – Seriya III, Fizika i Astronomiya (VMU) published in 1948 to 1969 and 1996 to the present do not have volume numbers.

## 2.8 EXFOR Coding Rule

**O. Schwerer** reviewed the usage of the keyword RAD-DET and its relation to DECAY-DATA and PART-DET. After summarizing the difference between these three keywords and actual usage of RAD-DET in various EXFOR areas, he discussed relevant paragraphs in the EXFOR Formats Manual and LEXFOR, and also presented examples of good and redundant usage of RAD-DET. He finally proposed participants to check usage of RAD-DET whenever an entry containing this keyword is retransmitted, and to delete this keyword when it is redundant.

**O. Schwerer** pointed out the use of the branch code M- is confusing in many cases, and proposed to limit its use when it appears as CUM/M-. **N. Otsuka** supported his proposal, and proposed to use the branch code IND only in combination with the parameter code FY. These proposals were accepted after considering the comments on the usage of M- from **S. Takács** and **S.C. Yang**.

**M. Mikhailiukova** presented the same data set compiled in two subentries 41202.002 (STATUS=CURVE, uncertainties given for all data points) and 41224.002 (STATUS=SCSRS, uncertainties given except for three data points). The participants concluded that EXFOR 41224 will be merged into EXFOR 41202 after deletion of 41224.002.

## 2.9 Tools for Compilation and Dissemination

**G. Pikulina** introduced “TRANS mode” implemented in the EXFOR-Editor Ver.4.0. This mode allows users various operations for preparation of a tape (*e.g.*, sorting, ordering, checking, plotting).

**V. Zerkin** presented and demonstrated recent developments of EXFOR-CINDA-ENDF-IBANDL web database retrieval system and other data services such as plotting of fission product yield related quantities via C4/C5 by ZVView and pdf database statistics.

## **2.10 Other Business**

**A. Lewis** reported problems in the uncertainty information coded under the keyword ERR-ANALYS progress and proposed use of an uncertainty template for more consistent and complete reporting of the uncertainty information.

**T. Zholdybayev** reported progress in compilation of data measured by his institute. He reported that five new EXFOR entries were compiled from newly published articles since the last NRDC meeting. He also reported progress in compilation of data published in old articles by scanning (1) the Kazakh journal “Izvestya of Kazakh Academy of Science” (for creation of four new entries) , and (2) preprints and laboratory logbooks kept in his institute (for revision of ten entries).

**Wang Jimin** (on behalf of Ge Zhigang) presented the preparation status of the ND2019 conference such as the committee members, statistics of abstracts and conference venue.

## **2.11 Closing**

**N. Otsuka** proposed the dates and places for the next full NRDC meeting (Vienna, Austria, 18 to 22 May 2020) and the next technical NRDC meeting (Vienna, 2nd quarter of 2021), and they were approved.

The participants reviewed the draft of the Conclusions and Actions.

**M. Fleming** called an adjournment of the meeting, and the participants thanked for his excellent chairmanship.



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## AGENDA

Tuesday, 9 April 2019

9:30 – 13:00

**1. Opening Items**

1.1	Welcome address	10 min		A. Koning
1.2	Self-introduction	10 min		All
1.3	Announcement	5 min		L. Vrapcenjak
1.4	Election of chairperson, adoption of the agenda, announcements	5 min		N. Otsuka

**2. Progress Reports**

2.1	CJD (Obninsk, Russia)	10 min	P2019-01	M. Mikhailiukova
2.2	CDFE ((Moscow, Russia)	10 min	P2019-02	V. Varlamov
2.3	JCPRG (Sapporo, Japan)	10 min	P2019-03	T. Tada
2.4	CNPD (Sarov, Russia)	10 min	P2019-04	S. Taova
2.5	UkrNDC (Kyiv, Ukraine)	10 min	P2019-05	O. Gritzay
2.6	NDS (Vienna, Austria)	10 min	P2019-06	A. Koning
2.7	KNDC (Daejeon, Korea)	10 min	P2019-07	S.C. Yang
2.8	ATOMKI (Debrecen, Hungary)	10 min	P2019-08	S. Takács
2.9	NDPCI (Mumbai, India)	10 min	P2019-09	V. Devi
2.10	NEA DB (Paris, France)	10 min	P2019-10	M. Fleming
2.11	CNDC (Beijing, China)	10 min	P2019-11	Wang Jimin
2.12	NNDC (Upton, USA)	10 min		B. Pritychenko

*150 min*

14:00 – 18:00

**3. EXFOR Statistics and Coverage**

3.1	Transmission statistics since the last NRDC meeting	10 min	WP2019-02	N. Otsuka
3.2	Status of new article compilation (A1)	10 min	WP2019-03	N. Otsuka
3.3	Statistics of review and finalization of preliminary tapes	10 min	WP2019-04	S. Okumura
3.4	New publications scanned by NDS	10 min	WP2019-05	S. Okumura
3.5	Retroactive scanning of regularly scanned journals (CP-D/972)	10 min	WP2019-06	S. Selyankina
3.6	Progress in correction of items on Feedback List (A2)	10 min	WP2019-07	N. Otsuka
3.7	Other actions (A3)	10 min		Chairperson

**4. Manuals and Dictionary**

4.1	LEXFOR “Sums” and EXFOR Formats “Sample” (A8, CP-D/964)	10 min	WP2019-08	N. Otsuka
4.2	REACTION codes with SF6=POL and SF8=ASY (CP-D/970)	10 min	WP2019-09	N. Otsuka
4.3	Chapter "Kerma factor" for LEXFOR (4C-4/219)	10 min	WP2019-10	M. Mikhailiukova
4.4	LEXFOR “Institute” (CP-D/976)	20 min	WP2019-11	N. Otsuka
4.5	New web quantity (CP-D/975)	20 min	WP2019-12	N. Otsuka
4.6	New codes proposed by NEA DB (CP-N/146, CP-N/147, CP-N/149)	10 min	WP2019-13	M. Fleming
4.6	Other actions (A4-A7, A9-A12)	10 min	WP2019-01	Chairperson

*160 min*

### Wednesday, 10 April 2019

**9:30 – 13:00**

#### **5 CINDA**

5.1	Status of CINDA database (A13)	10 min	WP2019-14	V. Zerkin
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#### **6 EXFOR Compilation Needs**

6.1	Compilation of articles from completeness checking (A14)	10 min	WP2019-15	N. Otsuka
6.2	Completeness checking for articles published in JET (Vols. 1 to 127, CP-D/971)	10 min	WP2019-16	S. Selyankina
6.3	Results of scanning of 57MOSCOW and 60MOSCOW (CP-F/018)	10 min	WP2019-17	S. Dunaeva
6.4	Compilation of articles with priority (A15-A25)	10 min	WP2019-18	N. Otsuka
6.5	EXFOR/NSR completeness checking: Fission product yields (CP-C/464, CP-C/465, CP-C/466)	20 min	WP2019-19	B. Pritychenko
6.6	Experimental fission product yields adopted in ENDF and UKFY evaluation but missing in EXFOR (A29)	20 min	WP2019-20	S. Okumura
6.7	New keyword - SUPPL-INF (A32, CP-D/965 Rev)	10 min	WP2019-21	O. Gritzay
6.8	Atomic data compilation in EXFOR Library (CP-C/468)	20 min	WP2019-22	B. Pritychenko
6.9	Other actions (A26-A28, A30-A31, A33)	10 min	WP2019-01	Chairperson

*140 min*

**14:00 – 18:00****7 EXFOR Quality Control**

7.1	Pending corrections (A34-A44)	10 min	WP2019-23	N. Otsuka
7.2	Volume numbers for VMU (Vestnik Moskovskogo Universiteta - Seriya III, Fizika i Astronomiya) (A49, CP-M/036)	10 min	WP2019-24	V. Varlamov
7.3	Bibliographic errors in EXFOR (CP-N/148)	10 min	WP2019-25	M. Fleming
7.4	Other actions (A45-A48, A50-A54).	20 min	WP2019-01	Chairperson

**8 Software and Dissemination**

8.1	Functionality enhancement of the EXFOR-Editor software package for experimental nuclear data compilation into the EXFOR format	20 min	WP2019-26	G. Pikulina
8.2	Recent development of "EXFOR-CINDA-ENDF-IBANDL" Web database retrieval system, PDF database, Web tools and software (A71-A80)	50 min		V. Zerkin
8.3	2D image calibration in digitizing process (A81)	90 min		V. Zerkin
8.4	Other actions (A56-A70, A82-A83)	10 min	WP2019-01	Chairperson

*170 min***19:00 –**

Social dinner (Georgsaal, Salm Bräu - Rennweg 8, 1030 Wien)

**Thursday, 11 April 2019****9:30 – 13:00****9 EXFOR Coding Rule**

9.1	Usage of RAD-DET and its relation to DECAY-DATA and PART-DET (CP-C/393)	30 min	WP2019-27	O. Schwerer
9.2	Coding isomeric cross sections (CP-C/467)	30 min	WP2019-28	O. Schwerer
9.3	Simplification of REACTION codes for independent (IND) quantities (CP-D/977)	30 min	WP2019-29	N. Otsuka
9.4	Pn value determined as ratio of delayed neutron multiplicity to fission yield (4C-3/414 Rev.)	10 min	WP2019-30	N. Otsuka

9.5	Illegal REACTION SF <sub>2</sub> =SF <sub>3</sub> (CP-D/960)	10 min	WP2019-31	N. Otsuka
9.6	Status code NCHKD (CP-D/973)	20 min	WP2019-32	N. Otsuka
9.7	Fission yield ratios (isomeric ratio and fractional yield) (CP-D/974)	10 min	WP2019-33	N. Otsuka
9.8	Conference proceedings published in report series (CP-D/968)	10 min	WP2019-34	N. Otsuka
9.9	Discussion of data from Subents 41202.002 and 41224.002 (4C-4/222)	10 min	WP2019-35	M. Mikhailiukova
9.9	Other actions (A55)	10 min	WP2019-01	Chairperson

*170 min*

#### **14:00 – 18:00**

##### **10. Other items**

10.1	EXFOR: fortified to better serve	30 min		J.-C. Sublet
10.2	Incorporation of uncertainty templates into EXFOR	30 min		A. Lewis
10.3	Compilation of experimental nuclear reaction data from Central Asia	10 min	WP2019-36	T. Zholdybayev
10.4	ND2019 conference (19-24 May 2019)	10 min		Wang Jimin

*80 min*

### **Friday, 12 April 2019**

#### **9:30 – 13:00**

##### **11. Closing**

11.1	Dates and places of next meetings	10 min		N. Otsuka
11.2	Review of actions and conclusions	60 min		Chairperson
11.3	Closing address	10 min		

*80 min*

## CONCLUSIONS AND ACTIONS

### Conclusions

#### General

- C1 The next full NRDC meeting will be held in Vienna, Austria between 18 and 22 May 2020 (4 or 5 days) N.B. 1 July 2020 is the 50th anniversary of the first EXFOR exchange).
- C2 Each Centre will be encouraged to submit an item for addition in the agenda of the planned 50th anniversary session of the next full NRDC meeting (*e.g.*, short presentation about the history of the relation between the centre and NRDC).
- C3 The next technical NRDC meeting will be held in Vienna, Austria in the 2nd quarter of 2021.
- C4 The next EXFOR compilation workshop will be held in Vienna, Austria in the 4th quarter of 2020.

#### EXFOR Statistics and Coverage

- C5 NNDC will scan each issue of IMP/E, and provide the results to NDS.

#### Manuals and Dictionary

- C6 Revision of EXFOR Formats Manual “SAMPLE” and LEXFOR “Sums” (CP-D/964=WP2019-08) was approved after replacing “412 keV gamma” with “412 keV prompt gamma”.
- C7 Revision of LEXFOR “Polarization” (CP-D/970=WP2019-09) was approved.
- C8 Addition of LEXFOR “Kerma factors” (4C-4/219=WP2019=10) was approved.
- C9 Revision of LEXFOR “Institute” (CP-D/976=WP2019-11) was approved after the elimination of the sentence “The sequence of the institutes should be the same as in the primary reference.”.
- C10 Two new dictionaries (Dictionaries 114 and 115) are ready for testing by retrieval systems.
- C11 New codes (TER,FY,,RES; CI/ASECMEV; ISP,SIG; ,DA,,RS/TMP) proposed by NEA Data Bank (CP-N/146, 147 and 149=WP2019-13) were approved.
- C12 Creation of Dictionary 38 (Supplemental information) proposed in CP-D/965 Rev=WP2019-21 was approved.

## **EXFOR Compilation Needs**

- C13 Completeness of fission product yields in EXFOR was checked by two independent methods – (1) checking of EXFOR against NSR (CP-C/464, 465 and 466=WP2019-19), and (2) checking of EXFOR against citation lists of evaluation summary by Mills for UKFY and England & Rider for ENDF (WP2019-20).
- C14 New keyword SUPPL-INF (supplemental information) and relevant update of manuals (EXFOR Formats Manual “REACTION” and “SUPPL-INF” as well as LEXFOR “Supplemental information”) proposed in CP-D/965 Rev=WP2019-21 were approved. Note that only two keywords SUPPL-INF and HISTORY are allowed in the BIB section providing the supplemental information.
- C15 The ENDF library community needs an experimental atomic reaction database for validation purposes.

## **EXFOR Quality Control**

- C16 Volume numbers of VMU (Vestnik Moskovskogo Universiteta – Seriya III, Fizika i Astronomiya) are absent for the issues published in 1948 to 1969 and 1996 to the present.

## **EXFOR Coding Rule**

- C17 Revisions of the EXFOR Formats Manual and LEXFOR proposed by Memo CP-C/393=WP2019-27 were approved.
- C18 Redundant information should be included only when there is a good reason specific to the entry. Furthermore, the length of a BIB section should not be increased when neither additional information nor a better explanation is offered - this makes the entry less user friendly. (c.f. CP-C/393=WP2019-27)
- C19 Revision of LEXFOR “Independent and cumulative data” proposed in Memo CP-D/977 Rev. (= WP2019-29 Rev.) was approved.
- C20 The branch code IND will be used only when SF6=FY.
- C21 Revisions of LEXFOR “Data type” and “Delayed fission neutrons” proposed in Memo 4C-3/414 Rev.=WP2019-30 were approved.
- C22 The code coded in REACTION SF2 cannot be repeated in REACTION SF3 (c.f. CP-D/960=WP2019-31).
- C23 The expansion of the status code NCHKD will be “authenticity not confirmed”. The code is used only when there is no other status code applicable (e.g., NDD, SCSRS). However, the data tabulated or plotted by other than the experimentalist will not be compiled in the future. Revision of LEXFOR “Status” proposed by Memo CP-D/973=WP2019-32 was approved.



- C24 Revision of LEXFOR “Ratios” and “Fractional” as well as dictionary updates proposed in Memo CP-D/974=WP2019-33 were approved.
- C25 Conference proceedings published in CEA-CONF, CONF, NBS-SPEC-PUB or STI/PUB report should be coded with the conference code.
- C26 EXFOR 41224 will be merged into EXFOR 41202 after deletion of 41224.002 (4C-4/222=WP2019-35).

### **Tools for Compilation and Dissemination**

- C27 The CNPD EXFOR-Editor has a new function to assemble EXFOR entries to prepare a TRANS tape.
- C28 The EXFOR leaflet was edited by CNPD, which has been printed by CNDC and distributed via the NRDC.
- C29 Compilers are encouraged to inform the NSR compiler(s) if EXFOR entries are deleted or modified in such a way that affects the NSR database.

## **Actions**

### **EXFOR Statistics and Coverage**

- A1 All (Standing action) Give the highest priority to compilation of new articles.
- A2 All (Standing action) Correct erroneous entries listed on the EXFOR Feedback List according to the indicated priorities. All urgent corrections must be done by the next meeting.
- A3 Otsuka (Continuing action) Send transmission statistics and correction statistics to centres every three months.

### **Manuals and Dictionaries**

- A4 Otsuka (Continuing action) Update Dictionaries every four months.

- A5 Otsuka (Continuing action) Revise the EXFOR Formats Manual for
- (1) "DECAY-DATA" and "RAD-DET" (CP-D/874=WP2016-28),
  - (2) "Reaction specification" (CP-D/880 Rev.=WP2016-29, CP-D/896=WP2016-33, CP-N/143=WP2018-12),
  - (3) "LEVEL-PROP" (CP-D/882=WP2016-30),
  - (4) "ERR-ANALYS" (CP-D/894 Rev.=WP2016-32),
  - (5) "FACILITY" (CP-D/899=WP2016-34),
  - (6) "REFERENCE" (CP-C/452=WP2017-08, CP-D/920=WP2017-33, CP-D/953Rev=WP2018-08, NRDC2018 Conclusion 4),
  - (7) "STATUS" (CP-D/915=WP2017-09),
  - (8) "INC-SPECT" (CP-D/932=WP2017-31),
  - (9) BIB Section (CP-D/942=WP2018-09),
  - (10) "SAMPLE" (CP-D/964=WP2019-08),
  - (11) "REACTION" and "SUPPL-INF" (CP-D/965 Rev.=WP2019-21).
  - (12) "DECAY-DATA", "PART-DET" and "RAD-DET" (CP-C/393=WP2019-27).
- A6 Otsuka (Continuing action) Revise LEXFOR for
- (1) "Thermal Neutron Scattering" (4C-3/403 =WP2016-08),
  - (2) "Fission Yields" (CP-D/895=WP2016-09),
  - (3) "Thick- and thin-target yields" (CP-D/893=WP2016-31),
  - (4) "Isomeric flags" (CP-D/896=WP2016-33),
  - (5) "Status" (CP-D/904=WP2016-35, CP-C/443=WP2016-36),
  - (6) "Sample" (CP-D/928=WP2017-35),
  - (7) "Multilevel Resonance Parameters" (CP-D/953Rev=WP2018-08),
  - (8) "Reference" (CP-D/953Rev=WP2018-08),
  - (9) "Thermonuclear reaction rate" (CP-D/956=WP2018-11),
  - (10) "Sums" (CP-D/964=WP2019-08),
  - (11) "Polarization" (CP-D/970=WP2019-09),
  - (12) "Kerma factor" (4C-4/219=WP2019-10),
  - (13) "Institute" (CP-D/976=WP2019-11),
  - (14) "Supplemental information" (CP-D/965 Rev.=WP2019-21).
  - (15) "Decay data" and "Outgoing particles" (CP-C/393=WP2019-27),
  - (16) "Independent and Cumulative data" (CP-D/977 Rev.=WP2019-29 Rev.),
  - (17) "Data type" and "Delayed fission neutrons" (4C-3/414 Rev.=WP2019-30) but removing SF5=IND,
  - (18) "Status" (CP-D/973=WP2019-32),
  - (19) "Ratios" (CP-D/974=WP2019-33),
  - (20) "Fission yields" (CP-D/974=WP2019-33).
- A7 Zerkin Fleming (Continuing action) Summarize the role of family flags (also known as family codes, c.f. EXFOR Formats Manual Chapter 6) in ZCHEX (c.f. WP2017-11) and verify their potential use in JANIS.

- A8 Otsuka Propose a revised NRDC Protocol Appendix B “Scanning responsibility” for elimination of journals assigned to a centre but also scanned by NDS (c.f. WP2019-05).
- A9 Zerkina  
Otsuka Propose a numbering scheme for compound codes defined in Dictionary 209.
- A10 Otsuka Check if we can make the process code EC (electron capture) obsolete.
- A11 Otsuka Update Dictionary 34, 37 and 236 as suggested CP-D/974=WP2019-33.

## CINDA

- A12 Zerkina (Continuing action) Export EXFOR to CINDA, and distribute it to other Centres every month.
- A13 Zerkina  
Sublet Keep NRDC informed about the situation about import of NSR to CINDA.

## EXFOR Compilation Needs

(Underlined items are registered in the Article Allocation List.)

- A14 Fleming (Continuing action) Compile with priority the articles cited in the NACRE II (an update and extension of European Compilation of Reaction Rates for Astrophysics) listed in Tables 1 and 2 of CP-D/833.
- A15 Pritychenko (Continuing action) Compile with priority articles related to the neutron dosimetry cross sections listed in the second table of CP-D/838.
- A16 Pritychenko (Continuing action) Compile the thermal neutron-induced reaction data cited in Mughabghab’s “Atlas of Neutron Resonances” and listed in 4C-3/395.
- A17 Pritychenko (Continuing action) Compile with priority prompt fission neutron multiplicities listed in CP-D/871.
- A18 Fleming  
Pritychenko (Continuing action) Compile articles presented in Reactor Dosimetry Symposia listed in 4C-3/400=WP2016-16.
- A19 Fleming  
Pritychenko (Continuing action) Compile thermal neutron scattering data listed in 4C-3/404= WP2016-19.
- A20 Pritychenko (Continuing action) Compile Pn values adopted in Rudstam’s review (4C-3/410=WP2018-20).

- A21 Pritychenko (Continuing action) Compile with priority the proton-induced isotope  
Tada production cross sections listed in CP-D/725 Rev. (~WP2012-19).  
Notify Okumura if the assigned centre does not compile the high energy  
( $E > 1$  GeV) data in the list.
- A22 Pritychenko (Continuing action) Compile with priority the articles related to ion  
Taova beam analysis application listed in CP-D/832 Rev.
- A23 Pritychenko (Continuing action) Compile with priority the light charged-particle  
Tada induced isotope production cross sections listed in CP-D/757. Notify  
Taova Okumura if the assigned centre does not compile the high energy ( $E > 1$   
GeV) data in the list.
- A24 Pritychenko (Continuing action) Compile with priority the neutron source spectra  
Tada listed in CP-D/700 (Rev.3).
- A25 Devi Compile articles reporting experimental fission product yields and listed  
Fleming in CP-C/464, 465 and 466. Inform Okumura if an article in the lists is  
Gritzay not for EXFOR compilation. Transmit EXFOR entries relevant to these  
Mikhailiukova lists (and WP2019-20) separately from other EXFOR entries.  
Okumura  
Pritychenko  
Tada  
Varlamov  
Wang
- A26 Fleming Compile articles reporting experimental fission product yields and listed  
Devi in WP2019-20. Inform Okumura if an article in the list is not for  
Mikhailiukova EXFOR compilation. New and revised EXFOR entries relevant to these  
Wang lists must be transmitted separately from other EXFOR entries. Transmit  
Okumura EXFOR entries relevant to this list (and CP-C/464, 465 and 466)  
Pritychenko separately from other EXFOR entries.
- A27 Pritychenko Compile deuteron-induced reaction data compiled by the Frascati group  
and listed in CP-D/758.
- A28 Gritzay Compile articles published in the “Nuclear Spectroscopy and Structure”  
(Nucleus) conference proceedings and listed in CP-D/881.
- A29 Gritzay Compile articles published in JEL and listed in CP-D/952.  
Okumura  
Taova
- A30 Gritzay Compile data measured with filtered neutrons measured at the KINR  
research reactor with numerical neutron spectra.
- A31 Pritychenko (Continuing action) Monitor availability of P.E. Koehler’s time-of-flight  
spectra on DVDs received from ORELA in 2015 for EXFOR  
compilation.

- A32 Pritychenko (Continuing action) Compile  $^{238}\text{U}(n,f)$  cross sections in Table 4.6 of Zchariah W. Miller's thesis (Univ. of Kentucky, 2015).
- A33 Fleming Sublet (Continuing action) Receive the experimental fission product yield data collected by Robert Mills. Identify the numerical data sets missing in EXFOR once they are received.
- A34 Pritychenko (Continuing action) Perform EXFOR completeness checking for the list of articles (4C-3/401, 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 by a memo.
- A35 Zholdybayev (Continuing action) Scan domestic publications (e.g., journals, laboratory reports) to identify articles for EXFOR compilation.

### **EXFOR Quality Control**

(Underlined items are registered in the EXFOR Feedback List.)

- A36 Varlamov (Continuing action) Correct reference code for VMU, and add its English translation (MUPB) under REFERENCE in M0293.001 as listed in CP-F/015=WP2018-26.
- A37 Mikhailiukova (Continuing action) Add English translation information of Russian journals (KSF, FCY, ZET, ZTF) under REFERENCE as listed in Memo CP-D/957=WP2018-24.
- A38 Mikhailiukova Varlamov (Continuing action) Correct reference codes including the year of publication in the volume number field listed in Memo 4C-4/216. (N.B. CJD reported progress in correction in Memo 4C-4/218).
- A39 Fleming Mikhailiukova Pritychenko Revise REACTION codes coded with SF6=POL and SF8=ASY listed in Memo CP-D/970=WP2019-09.
- A40 Fleming Pritychenko Varlamov Revise reference codes under REFERENCE and listed in Tables 1 and 2 of Memo CP-N/148=WP2019-25.
- A41 Pritychenko Revise illegal REACTION codes (SF2=SF3) listed in CP-D/960=WP2019-31.
- A42 Okumura Revise EXFOR entries having STATUS=NCHKD listed in CP-D/973=WP2019-32.
- A43 Mikhailiukova Check if TABLE can replace NCHKD by checking the source articles for 15 entries listed in CP-D/973=WP2019-32.

- A44 Pritychenko Replace the report code with conference code in EXFOR 13224 (CP-D/968=WP2019-34).
- A45 Mikhailiukova Merge EXFOR 41224 into EXFOR 41202 after deletion of 41224.002 (4C-4/222=WP2019-35).
- A46 Fleming (Continuing action) Consider addition of numerical data which are not superseded (SPSDD) and suitable for digitization, 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  $^{239}\text{Pu}$ .
- A47 Fleming (Continuing action) Check the n-p scattering data set in EXFOR 22207.002 (G. Fink) against G. Fink's thesis (e.g., reference frame – lab or c.m.).  
Otsuka
- A48 Fleming (Continuing action) Provide a report on mistakes in bibliographies and spells on each preliminary tape.
- A49 Otsuka (Continuing action) Revise EXFOR entries compiling data sets from ORELA 40 m flight station listed in the Appendix of 4C-3/407=WP2017-30 by addition of  
Pritychenko
  - 1) the corrigendum under REFERENCE of the common subentry,
  - 2) STATUS=OUTDT to each data subentry with the correction factor in free text.
- A50 Otsuka (Continuing action) Submit a revised Memo CP-D/933 by addition of the remark to each subentry from Takács.
- A51 Fleming (Continuing action) Following A45, revise the REACTION codes of the thick target considering the changes proposed in Appendix of CP-D/933=WP2017-28 once the originating centre receives extraction of Revised Memo CP-D/933 from Otsuka. Revised entries must be assembled in a preliminary tape without including other entries to make trace of corrections at NDS easier.  
Otsuka  
Tada  
Taova
- A52 Soppera (Continuing action) Provide JANIS Import Log created from the EXFOR Master File to Otsuka on a regular basis.
- A53 Otsuka (Continuing action) Assess the JANIS Import Log provided by Soppera as above, and register important errors to the EXFOR Feedback System.
- A54 Okumura Check if the usage of REACTION SF5=CUM/M- and (CUM)/M- in the EXFOR Master is consistent with CP-D/977 Rev.=WP2019-29 Rev.

### **Tools for Compilation and Dissemination**

- A55 Fleming (Continuing action) Make available on the NEA Data Bank web site the EANDC and NEANDC reports compiled in EXFOR and not available as INDC reports.

- A56 Pikulina (Continuing action) Continue development and testing of the EXFOR-Editor and InpGraph in cooperation with NDS and other data Centres.
- A57 All (Continuing action) Provide Pikulina feedback on EXFOR-Editor and InpGraph.
- A58 Kimura (Continuing action) Continue development and testing of GSYS in cooperation with NDS and other centres.
- A59 All (Continuing action) Provide Kimura feedback on GSYS.
- A60 Soppera (Continuing action) Continue development and testing of the JANIS TRANS Checker in cooperation with NDS and the other centres.
- A61 All (Continuing action) Provide Soppera feedback on JANIS TRANS Checker.
- A62 Bhattacharyya (Continuing action) Keep centres informed about the progress in development of the EXFOR-I editor.
- A63 Nayak (Continuing action) Monitor progress in development of the EXFOR-I editor.
- A64 Otsuka (Continuing action) Provide EXFOR News every month and consider updates to the IAEA NDS website.
- A65 Otsuka (Continuing action) Support update of the Japanese editor (HENDEL) as time permits.
- A66 Zerkin (Continuing action) Update ZCHEX based on comments from compilers.
- A67 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.
- A68 Zerkin (Continuing action) Develop and distribute the program package including a standalone platform independent program to generate X4+ from a standalone EXFOR entry.
- A69 All (Continuing action) Consider to use the X4+ format for author approval, and also send feedback to Zerkin.
- A70 Zerkin (Continuing action) Continue development of the EXFOR upload web tool.

- A71 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.
- A72 Zerkin (Continuing action) Continue development of the additional database encompassing correction factors and relevant comments for suspect/erroneous data (X4-evaluated) presented in WP2010-19; keep NRDC informed about results, impact and usage statistics of the database.
- A73 Mikhailiukova  
Dunaeva  
Zerkin (Continuing action) Clarify the requirements for the introduction of flags to indicate articles published in conference proceedings where the data are not available from the authors on the EXFOR Compilation Control System web page.
- A74 Zerkin  
Okumura (Continuing action) Consider translation of fission yields in EXFOR to a C4-like format in consultation with experts in the field.
- A75 Zerkin  
Pritychenko (Continuing action) Continue translation from EXFOR to NSR.
- A76 Jin  
Kimura  
Pikulina  
Zerkin (Continuing action) Study problems in 2D calibration of original pictures, and process of approval of results of digitizing using plotting facilities.
- A77 Fleming  
Okumura  
Pritychenko (Continuing action) Finalize and submit EXFOR entries including covariance data provided by Zerkin (WP2017-Z3).
- A78 All (Standing action) Provide Zerkin a list of name aliases to improve the search of EXFOR entries by the author name (WP2014-53).



## Appendix D

### LIST OF PROGRESS REPORTS

Number	Title	Presented by
P2019-01	CJD progress report for NRDC2019 Technical Meeting	M Mikhailiukova
P2019-02	The CDFE Progress Report on the photonuclear data compilation and evaluation activity for 2018/2019	V.V. Varlamov
P2019-03	Japan Nuclear Reaction Data Centre (JCPRG) progress report	T. Tada
P2019-04	Center of Nuclear Physics Data (CNPD), RFNC-VNIIEF technical paper for the NRDC Meeting	S. Taova
P2019-05	Ukrainian Nuclear Data Centre progress report, 2018/19	O. Gritzay
P2019-06	IAEA Nuclear Data Section: progress report for period 2018/19	A. Koning
P2019-07	Nuclear Data Center (NDC) of KAERI	S.C. Yang
P2019-08	Progress Report of ATOMKI	S. Takács
P2019-09	NDPCI Progress report: Nuclear data activities in India 2018-2019	V. Devi
P2019-10	OECD-NEA Data Bank	M. Fleming
P2019-11	2018/19 status report of China Nuclear Data Center	Wang Jiming

Note: These progress reports are available online: [http://www-nds.iaea.org/nrdc/nrdc\\_2019/](http://www-nds.iaea.org/nrdc/nrdc_2019/).



## LIST OF WORKING PAPERS

Number	Title	From
WP2019-01	Conclusions and action of the 2018 NRDC Meeting	
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WP2019-36	Compilation of experimental nuclear reaction data measured in Central Asia region	T.Zholdybayev

Note: These working papers are available online: [http://www-nds.iaea.org/nrdc/nrdc\\_2019/](http://www-nds.iaea.org/nrdc/nrdc_2019/)

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JCPRG progress report	T.Tada
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Ukrainian Nuclear Data Centre progress report, 2018/19	O.Gritzay
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Recent development of "EXFOR-CINDA-ENDF-IBANDL" Web database retrieval system, PDF database, Web tools and software	V.Zerkin
EXFOR: fortified to better serve	J.-C.Sublet
Incorporation of uncertainty templates into EXFOR	A.Lewis
Compilation of experimental nuclear reaction data measured in Central Asia region	T.Zholdybayev
Preparation status of ND2019	Ge Zhigang

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