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I N D C INTERNATIONAL NUCLEAR DATA COMMITTEE

Nuclear Structure and Decay Data (NSDD) Evaluators' Network

Prepared by

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March 2004

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Abstract

The structure, principal activities and products of the Nuclear Structure and Decay Data (NSDD) Evaluators' Network are described. This revision supersedes the special issue of the Nuclear Data Newsletter No. 20 published in November 1994, and defines the status of the NSDD Network as of November 2003.

March 2004

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1. Network organization and co-ordination

The Nuclear Structure and Decay Data (NSDD) Evaluators' Network is an international network of experts which provides recommended nuclear structure and decay data to be used in basic and applied research. These data include:

- bibliographic information, and
- evaluated numerical data.

Evaluated nuclear quantities include the following:

- disintegration energies, radiation and transition probabilities,
- nuclear level schemes, excitation energies, half-life, decay modes,
- level spin-parity values,
- magnetic and electric multipole moments, and
- nuclear band structure.

The nuclear data and information available worldwide via the Internet, on CD-ROM and diskette are up-to-date, evaluated by experts, and easily accessed via convenient software tools.

The NSDD network was established in 1974 under the auspices of the International Atomic Energy Agency (IAEA), and includes 17 data centres and groups located in laboratories, institutes and universities within 10 countries. Network scientists evaluate nuclear structure and decay data for all isotopes on a continual basis. NSDD databases contain these data in computerised format and are available both online and offline. These evaluations are also published in the journals *Nuclear Physics A* and *Nuclear Data Sheets*.

The NSDD Network welcomes participation from other groups interested in contributing to this activity. Biennial meetings of the NSDD Network are organised by the IAEA Nuclear Data Section at which policies, tasks and actions are discussed to improve the NSDD databases and user services. All questions related to the organization and participation at these meetings can be communicated to the IAEA Nuclear Data Section (services@iaend.iaea.org), and they will be forwarded to the Scientific Secretary of the NSDD Network.

Co-ordination in the 2-year time interval between NSDD meetings is mainly accomplished through information exchange between network participants. The ENSDF manager (Dr. Jagdish Tuli, tuli@bnl.gov) co-ordinates all work related to the preparation of evaluations for ENSDF and incorporation of horizontal evaluations into the ENSDF. The IAEA Nuclear Data Section (contact Dr. Alan Nichols, a.nichols@iaea.org) organizes biennial Network co-ordination meetings, sponsors IAEA workshops designed to train new nuclear structure and decay data evaluators, and maintains the NSDD web site at <http://www-nds.iaea.org/nsdd.html>.

2. Main databases and Network activities

2.1 Evaluated Nuclear Structure Data File (ENSDF), Experimental Unevaluated Data List (XUNDL), and Nuclear Science References (NSR)

Nuclear structure and decay data evaluated by network members form the computerised Evaluated Nuclear Structure Data File (ENSDF). The National Nuclear Data Center (NNDC) at Brookhaven National Laboratory, USA, maintains the ENSDF master file. Maintained on a continuous basis, this file is distributed to other data centres twice a year. Copies of the file are available from servers at other network distribution centres, although the up-to-date data can be retrieved directly from the NNDC web site (<http://www.nndc.bnl.gov>).

More than 20 internationally-recognized experts from more than 10 countries prepare complete evaluations or updates to ENSDF for separate mass chains or isotopes, and form the Network of ENSDF evaluators. Detailed information about the ENSDF evaluators and assigned responsibilities are given in Section 6.

Bibliographic information derived from publications of low- and intermediate-energy nuclear physics is contained in the computerised Nuclear Science References (NSR) file that is also maintained by the NNDC. Information on new references is published regularly in *Nuclear Data Sheets*.

The volume of nuclear structure and decay information has greatly increased over recent years for nuclei far from the line of stability and with high-spin states. The published data on these topics are compiled in ENSDF format soon after their publication, primarily at McMaster University, and are incorporated into the experimental unevaluated data library (XUNDL) maintained at the NNDC.

2.2 Nuclear data centres - electronic access to ENSDF and NSR data files

Both the NNDC (BNL, Upton, USA) and NDS (IAEA, Vienna, Austria) provide global online access to ENSDF and NSR databases through the Worldwide Web (see Section 3 for more details). The user can easily retrieve data and download files created in different formats via the Internet. Additionally, Web access to ENSDF and many NSDD-produced databases is available through a collaboration between the Isotopes Project, (LBNL, Berkeley, USA) and the Swedish Nuclear Data Project (Lund University, Sweden) - see Section 3.

2.3 Data files and libraries derived from ENSDF

Some ENSDF derivatives (e.g., MIRD and NuDat) provide data for applications through online access to ENSDF, and present the resulting data in formats most convenient for users. MIRD produces tables of radiations in the format adopted by the Medical Internal Radiation Dose Committee. Nuclear structure and decay data can be searched for and plotted interactively through NuDat, which provides an interface between web users and several databases that contain these data and some neutron-induced nuclear reaction information.

The number of servers that may provide previously retrieved data from ENSDF will increase as a consequence of free access to the NSDD databases via the Internet. Therefore, users should be aware that the data obtained from such servers might be out-of-date.

The ENSDF database is often used as a source of nuclear structure and decay data in other evaluations (*e.g.*, for libraries of evaluated reaction cross section data). These evaluations can obviously be revised without any update of the underlying nuclear structure and decay data to create a possibly misleading situation in which obsolete data are made a part of a newly evaluated data file. Therefore, direct reference to the source of evaluated NSDD data should be given to avoid ambiguity.

Some data files and libraries, such as atomic masses, nuclear moments can be considered as being complementary to ENSDF. These data are kept separately, and also can be retrieved through online access.

2.4 Horizontal evaluations and parallel activities

The updating of information within ENSDF involves replacing the old evaluations for particular masses or isotopes with the new data. However, an evaluation may be also prepared in response to the needs of a specific application, such as the evaluation of a particular parameter for a set of nuclei (*e.g.*, half-lives). Such evaluations are described as “horizontal” evaluations. The need for the timely incorporation of horizontal evaluations into ENSDF has been emphasized at a number of NSDD network meetings.

According to the procedures adopted at NSDD meetings, people intending to perform an ENSDF-related horizontal evaluation should inform the NSDD network before the start of such an effort. The ENSDF file manager, in consultation with the horizontal data evaluator, will develop a plan to incorporate the horizontal evaluation into the ENSDF database. Both the proposal and implementation plan will be circulated to the NSDD network for comment before being approved. Upon completion of an approved horizontal evaluation or an appropriate update, the ENSDF database manager will circulate the results to the network members for review. After network approval, the ENSDF file manager will be responsible for integrating the evaluated data into either individual nuclide or mass-chain evaluations, in consultation with the responsible ENSDF evaluators and according to the approved plan.

2.5 NSDD Network co-operation

Due to the complexity of the NSDD network and the involvement of many groups from different countries in different tasks, co-ordination is required to ensure that the work is carried out efficiently and to avoid duplication. The instruments of this co-ordination are the Technical Meetings held biennially under the auspices of the IAEA Nuclear Data Section (contact Dr. Alan Nichols, a.nichols@iaea.org). General co-ordination work between these meetings is provided by the ENSDF manager (Dr. Jagdish Tuli, Tuli@bnl.gov).

3. Web access to major databases

The two data centres (NNDC and IAEA) provide access to ENSDF and NSR through the Web. These centres maintain a very close co-operation that also includes the compilation of nuclear reaction data. The master files of ENSDF and NSR are updated and maintained by NNDC. These centres are as follows:

National Nuclear Data Center

- **Contact person:** Pavel Oblozinsky
- **Address:** National Nuclear Data Center
Bldg. 197D
Brookhaven National Laboratory
PO Box 5000
Upton, NY 11973-5000, USA
- **Telephone:** +1 631-344-2814
- **Fax:** +1 631-344-2806
- **E-mail:** oblozinsky@bnl.gov
- **Web:** <http://www.nndc.bnl.gov>

International Atomic Energy Agency - Nuclear Data Section

- **Contact person:** Alan L. Nichols
- **Address:** Wagramerstrasse 5, PO Box 100
A-1400 Vienna, Austria
- **Telephone:** +43 (1) 2600-21709
- **Fax:** +43 (1) 26007
- **E-mail:** a.nichols@iaea.org
- **Web** <http://www-nds.iaea.org>

The Nuclear Data Evaluation Project of Triangle University Nuclear Laboratory provides access to the latest evaluated data on the energy levels of light nuclei ($A = 3 - 20$):

TUNL Nuclear Data Evaluation Project

- **Contact person:** John F. Kelly
- **Address:** Triangle Universities Nuclear Laboratory
PO Box 90308
Durham, NC 27708-0308, USA
- **Telephone:** +1 919-660-2631
- **FAX:** +1 919-660-2634
- **E-mail:** kelly@tunl.duke.edu
- **Web:** <http://www.tunl.duke.edu/NuclData>

The Isotopes Project at the Lawrence Berkeley National Laboratory (LBNL) offers interactive Web access and the display of ENSDF data through the Isotope Explorer (IE) software, which was developed through collaboration between the Isotopes Project of LBNL, USA and the Swedish Nuclear Data Project at Lund University, Sweden. IE can be installed on user PCs (under MS Windows), and retrieves ENSDF data via the Internet or can access data stored locally. Web access to other NSDD-related data libraries and files is also provided through the Isotopes Project:

Isotopes Project

- **Contact person:** Coral M. Baglin
- **Address:** Isotopes Project
Lawrence Berkeley National Laboratory
M/S 88R0192, 1 Cyclotron Road
Berkeley, CA 94720-8101, USA
- **Telephone:** +1 510-486-6152
- **Fax:** +1 510-486-5757
- **E-mail:** cmbaglin@lbl.gov
- **Web:** <http://ie.lbl.gov>

4. Data available on-line and off-line

Nuclear structure data for mass chains and separate isotopes with $A < 20$ are published in the journal *Nuclear Physics A*, and incorporated into ENSDF by NNDC staff.

The 8th edition of the “**Table of Isotopes**”, John Wiley & Sons, Inc. is the latest in a series of publications started by Livingood and Seaborg in 1940. The Isotopes Project at LBNL prepared this publication in 1996 as both hardcopy and on CD-ROM that represents a comprehensive summary of the radioactive decay properties of the ground and excited states of nuclei. Updates to the 8th edition of the “**Table of Isotopes**” were published on CD-ROM in 1998 and 1999.

“**Nuclear Wallet Cards**” is published by the NNDC (6th edition, 2000). This publication summarises the ground- and metastable-state properties of nuclei, and is also available in HTML, PDF and PostScript formats online, downloaded from <http://www.nndc.bnl.gov> and <http://www-nds.iaea.org>.

Wall Charts of the Nuclides are published by KAPL (USA), KFK (Germany) and JAERI (Japan). KAPL published 16th edition of their Wall Chart in 2002.

Values for atomic masses, separation energies, and reaction energies (AME) are recommended by Centre de Spectrometrie Nucleaire et de Spectrometrie de Masse, Orsay, France in collaboration with the National Institute of Nuclear Physics and High-Energy Physics, Amsterdam, Netherlands. Their latest mass adjustment was published in *Nucl. Phys.* **A729** (2003) 129 and *Nucl. Phys.* **A729** (2003) 337, replacing the previous evaluation published in *Nucl. Phys.* **A565** (1993) 1 and *Nucl. Phys.* **A595** (1995) 409. These mass adjustment data are available in ASCII-text format online from the Atomic Mass Data Center, csnwww.in2p3.fr/amdc, with errata up to the present date. There are also many tables and graphs with different empirical and model predictions of the nuclear masses.

NUBASE is a database of evaluated nuclear structure and decay properties of nuclides in their ground and isomeric states. All nuclides for which some experimental information is known are considered. Data are adopted from ENSDF and AME, and the tables and plots of **NUBASE** are published in *Nucl. Phys.* **A729** (2003) 1; this publication replaces the previous evaluation published in *Nucl. Phys.* **A624** (1997) 1. Data are also available in PDF or ASCII text format online from the Atomic Mass Data Center, csnwww.in2p3.fr/amdc.

NUCLEUS is a PC software package used to display **NUBASE** data that can be freely downloaded from <http://csnwww.in2p3.fr/amdc/>.

NuDat is a software package that allows a user to search and plot nuclear structure and decay data interactively, providing an interface between the web and several databases containing such data and some neutron-induced nuclear reaction information. Nuclear level properties (energy, half-life and spin-parity), gamma-ray information (energy, intensity, multipolarity and coincidences), radiation information following nuclear decay (energy, intensity and dose), and neutron-induced reaction data from BNL-325 (thermal cross sections and resonance integrals) can be studied and extracted by means of this program.

MIRD is a computer program that accesses the evaluated radioactive decay data in the ENSDF database. Tables of radiations and decay schemes can also be produced in the format recommended and implemented by the Medical Internal Radiation Dose Committee.

Isotope Explorer has been developed by Chu, Ekström and Firestone, and is a Windows application to access and display nuclear data interactively and to search for literature references. This software package can retrieve data via the Internet, or use data stored locally. The program can display drawings of the nuclear level schemes, coincidences, tables, band plots, nuclear charts, chart data and literature references, and supports a nuclear chart interface. Systematics of nuclear properties can be displayed by colour coding a nuclear chart, and complex searches and calculations can be performed with the built-in script language.

XGStandards contains the recommended decay data for detector efficiency calibration, including half-lives and energies and emission probabilities of x-rays and gamma-rays of the calibrant radionuclides. These data can be provided on a PC diskette, and are the results of an IAEA Co-ordinated Research Project (CRP) from 1986 to 1990 published as IAEA-TECDOC-619 (1991). The results of a new CRP on "Update of X-ray and Gamma-ray Decay Data Standards for Detector Calibration and Other Applications" (1998-2003) will be available soon.

NaI(Tl) Gamma Spectrum Catalogue by Heath is a revised edition of IDO-16880-1, which was originally issued in August 1964 with a revised electronic update in February 1997. **Ge(Li)-Si(Li) Gamma Spectrum Catalogue** (Ge and Si detector spectra) was published originally in 1974 along with an electronic version by Heath and Helmer (Idaho National Engineering and Environmental Laboratory), with an update in September 1998; these data are also available on CD-ROM (March 1999) and online from <http://id.inel.gov/gamma>.

RadWare is a software package for interactive graphical analyses of gamma-ray coincidence data on Unix/Linux and OpenVMS platforms, as developed by Radford of the Physics Division at ORNL. This program can be freely downloaded from <http://radware.phy.ornl.gov/main.html>.

5. NSDD-related computer codes

Co-ordination of work on program development exists at the national level in the USA. The network maintains three types of computer codes, as described below.

5.1 General codes for on-line analysis, calculations and presentation of data in a format suitable for users

PhysCo is a set of codes for the calculation of physics quantities (e.g., internal conversion coefficients and $\log ft$ values) - available from NNDC and NDS Web sites.

QCalc can be used to calculate Q-values: allows the user to obtain decay Q-values, reaction Q-values and threshold energies (and their associated uncertainties), based on the values given in the Atomic Mass evaluation. Where possible, covariances are taken into account in the calculation.

5.2 Codes for analysis and calculations

Several computer programs are maintained and distributed by NNDC on behalf of the NSDD Network for the analysis and calculation of nuclear structure and decay data. These codes include the following:

- ALPHAD — calculates α R_0 , HF and theoretical $T_{1/2}(\alpha)$ data,
- DELTA — analyses angular correlation data,
- GABS — calculates absolute ΔI_γ data,
- GTOL — determines level energies from a least squares fit to E_γ data and feedings,
- HSICC — interpolates internal conversion coefficients,
- LOGFT — calculates $\log ft$, average beta energies and capture fractions,
- PANDORA — physics check of ENSDF datasets that aids in the adoption of gamma transitions and XREF,
- RadList — calculates atomic and nuclear radiations, and checks energy balance,
- RULER — calculates reduced transition probabilities.

5.3 ENSDF utility codes for preparing and checking evaluations

A group of programs are used to assist in the preparation and checking of the evaluations:

- ADDGAM — adds gammas to adopted data set,
- COMTRANS — converts the text comments of an ENSDF dataset to a "rich text format",
- ENSDAT — produces tables and drawings,
- FMTCHK — checks ENSDF format,
- TREND — Tabular display of ENSDF data.

These NSDD analysis and ENSDF utility codes require the input data to be in ENSDF format, and are available in ANSI-77 FORTRAN, Compaq/Digital Visual FORTRAN (WIN95/98/00/NT/XP), Linux, and OpenVMS FORTRAN from the NNDC and NDS Web sites. The most up-to-date NSDD analysis and ENSDF utilities codes can be accessed on the Web: http://www.nndc.bnl.gov/nndcscr/ensdf_pgm/code_status.html.

6. ENSDF evaluators, and evaluation responsibilities

ENSDF evaluators undertake the main evaluation work for ENSDF, and their studies are co-ordinated by the NNDC. Special procedures supported by computer programs represent the normal process of evaluation, reviewing, checking and inclusion of new evaluations in the ENSDF database.

The laboratories and institutions participating in mass-chain and nuclide evaluations for ENSDF along with their assigned areas of responsibility are listed in Table 1. These commitments are reviewed at the biennial NSDD co-ordination meetings. Evaluation groups that are unable to contribute to ENSDF over a continuous five-year period are removed from membership of the Network.

Table 1. ENSDF data evaluation centres, their mass-chain evaluation responsibilities and other activities, 2004-2005.

Center/Organization	Evaluation Responsibilities/Activities
<p><u>National Nuclear Data Center</u> Brookhaven National Laboratory PO Box 5000 Upton, NY 11973-5000, USA Contact: J. K. Tuli Tuli@bnl.gov</p>	<p>A-Chain Evaluations: 45-50, 57, 58, 60-73 (ex 62-64), 82, 84-86, 88, 94-97, 99, 136-148, 150, 152, 165</p> <p>Data Dissemination</p> <p>Maintenance of the Evaluated Nuclear Structure Data File (ENSDF) and editorship of the Nuclear Data Sheets</p> <p>Maintenance of ENSDF analysis and utility programs</p>
<p><u>Nuclear Data Project</u> Oak Ridge National Laboratory Oak Ridge, TN 37831, USA Contact: Yurdanur A. Akovali akovali@mail.phy.ornl.gov</p>	<p>A-Chain Evaluations: 213-293 (except 215, 216, 219, 220, 223, 224, 227, 228, 231, 232, 235, 236, 239)</p> <p>Data Dissemination</p> <p>RadWare Software</p>
<p><u>Isotopes Project</u> Lawrence Berkeley National Laboratory Berkeley, CA 94720, USA Contact: C. M. Baglin baglin@lbl.gov</p>	<p>A-Chain Evaluations: 21-30, 59, 81, 83, 90-93, 166-193 (ex 188, 190), 210-212, 215, 216, 219, 220, 223, 224, 227, 228, 231, 232, 235, 236, 239</p> <p>Data Dissemination</p>
<p><u>Idaho Group</u> Idaho National Engineering Laboratory EG & G Idaho, Inc. PO Box 1625 Idaho Falls, ID 83415, USA Contact: Richard G. Helmer helmerr@pcif.net</p>	<p>A-Chain Evaluations: 87, 153-163</p>

<p><u>TUNL Nuclear Data Evaluation Project</u> Triangle Universities Nuclear Laboratory PO Box 90308, Durham, NC 27708-0308, USA <i>Contact: John H. Kelley</i> kelley@tunl.duke.edu</p>	<p>A-Chain Evaluations: 2-20 Data Dissemination</p>
<p><u>Argonne National Laboratory</u> Building 362 9700 S. Cass Ave Argonne, IL 60439-4815, USA <i>Contact: F. Kondev</i> kondev@anl.gov</p>	<p>A-Chain Evaluations: 199-209</p>
<p>Nuclear Data Centre St. Petersburg Nucl. Phys. Inst. Gatchina, Leningrad Region 188 350, Russia <i>Contact: I. A. Mitropolsky</i> mitrplsk@hep486.pnpi.spb.ru</p>	<p>A-Chain Evaluations: 130-135</p>
<p>Centre d'Etudes Nucleaires DRF-SPH Cedex No. 85 F-38041 Grenoble Cedex, France <i>Contact: Jean Blachot</i> jblacho@cea.fr</p>	<p>A-Chain Evaluations: 101, 104, 107-109, 111, 113-117</p>
<p><u>Nuclear Data Center</u> Tokai Research Establishment JAERI Tokai-Mura, Naka-Gun Ibaraki-Ken 319-11, Japan <i>Contact: J. Katakura</i> Katakura@bisha.tokai.jaeri.go.jp</p>	<p>A-Chain Evaluations: 118-129 Data Dissemination</p>
<p>Nuclear Data Project Kuwait Institute for Scientific Research PO Box 24885 Kuwait, Kuwait <i>Contact: Ameenah R. Farhan</i> ameenah@kuc01.kuniv.edu.kw</p>	<p>A-Chain Evaluations: 74-80</p>
<p><u>Nuclear Structure and Nucleosynthesis</u> Laboratorium voor Kernfysica Universiteit Gent Proeftuinstraat 86 B-9000 Gent, Belgium <i>Contact: Denis De Frenne</i> denis.defrenne@rug.ac.be</p>	<p>A-Chain Evaluations: 102, 103, 105, 106, 110, 112</p>

<p><u>Department of Physics and Astronomy</u> McMaster University Hamilton, Ontario L8S 4K1, Canada <i>Contact: J. C. Waddington</i> JCW@physun.physics.mcmaster.ca</p>	<p>A-Chain Evaluations: 1, 31-44, 64, 89, 98, 100, 149, 151, 164, 188, 190, 194</p> <p>Compilation of experimental nuclear structure data</p> <p>Evaluation of super-deformed and magnetic dipole rotational bands</p>
<p>Institute of Atomic Energy PO Box 275 (41), Beijing People's Republic of China <i>Contact: Ge Zhigang</i> gezg@iris.ciae.ac.cn</p>	<p>A-Chain Evaluations: 195-198</p>
<p>Department of Physics Jilin University, Changchun People's Republic of China <i>Contact: Huo Junde</i> wldz@mail.jlu.edu.cn</p>	<p>A-Chain Evaluations: 51-56, 62, 63</p>
<p>Department of Nuclear Physics Australian National University Canberra ACT 0200, Australia <i>Contact: T. Kibedi</i> Tibor.Kibedi@anu.edu.au</p>	<p>A-Chain Evaluations: 172 (temporary)</p>

The NSDD network also includes groups working on horizontal evaluations (see Table 2).

Table 2. Centres with horizontal evaluation activities.

Responsible Centre	Contact person	Evaluation activity
Centre de Spectrometrie Nucleaire et de Spectrometrie de Masse, Batiment 108, F-91405 Orsay Campus, France http://csnwww.in2p3.fr/AMDC/web/	G. Audi audi@csnsm.in2p3.fr	Atomic Masses NUBASE
Physics Department, University of Oxford, Parks Road, Oxford OX1 3PU, United Kingdom	N. Stone n.stone1@physics.ox.ac.uk	Nuclear Moments
Department of Nuclear Research, Institute of Isotopes and Surface Chemistry, Chemical Research Centre, PO Box 77, H-1525 Budapest, Hungary		Thermal Neutron Capture Gammas
School of Physics, W507 Georgia Institute of Technology, Atlanta, GA 30332-0430, USA	J. Wood jw20@prism.gatech.edu	EL Systematics

7. Copyright issues and reference to Network products

The main products of the NSDD network are the results of the scientific work of many researchers involved in measurements, compilations and evaluations, and are distributed on a non-commercial basis. These products include ENSDF, a major database with unrestricted online access. Users are free to search and retrieve data, to re-process and re-format these data, and to use the data in their applications codes. The 1998 IAEA Advisory Group Meeting on the co-ordination of Network activities concluded that an “enormous value of the ENSDF file, distributed free of charge is often not fully appreciated”. AGM participants stressed that proper reference to ENSDF should be given if data are extracted from this file (see examples of possible wording below). Such an acknowledgement would help to avoid misunderstandings about the status of the data, and to what extent they are up-to-date. The primary direct reference to the source of original data should also be quoted. Data extracted from ENSDF (e.g., half-life for a particular nuclide) should be referenced to original work on which the evaluation was based.

An IAEA Co-ordination Meeting (IAEA Headquarters, 10–14 November 2003) recommended revision of the Copyright statement in the Network Document, proposing that all Network centres include the following or a similar statement on their Web front pages:

“One may use or reproduce data and information from this site with an appropriate acknowledgement and reference to the source of data. One may not charge any subsequent fee for these data”.

The above statement will probably not require any changes in the standard disclaimer:

“Distributed data products contain consensus values of physical constants. However, neither the NSDD network centres nor the IAEA guarantees the accuracy of such data products or their suitability for particular applied or scientific purposes”.

Referencing individual evaluations

To reference individual mass chains or parts of mass chain published in the Nuclear Data Sheets, the citation may be as given below, for example:

Huo Junde, Nuclear Data Sheets, 67, 523 (1992).

Referencing ENSDF

When referencing the Evaluated Nuclear Structure Data File (ENSDF) the citation should read:

“Data extracted from the Evaluated Nuclear Structure Data File, maintained by the National Nuclear Data Center, Brookhaven National Laboratory, Upton, NY 11973 USA, on behalf of the international Nuclear Structure Decay Data Evaluators’ Network: file as of date (e.g., 15 March 2004); data retrieved from site (e.g., www.nndc.bnl.gov)”.

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e-mail: services@iaeand.iaea.org
fax: (43-1) 26007
telephone: (43-1) 2600-21710

Online: TELNET or FTP: iaeand.iaea.org
username: IAEANDS for interactive Nuclear Data Information System
usernames: ANONYMOUS for FTP file transfer;
FENDL2 for FTP file transfer of FENDL-2.0;
RIPL for FTP file transfer of RIPL;
NDSOVL for FTP access to files saved in "NDIS" Telnet session.

Web: <http://www-nds.iaea.org>
