INDC International Nuclear Data Committee

NUCLEAR STRUCTURE AND DECAY DATA (NSDD) EVALUATORS' NETWORK

Prepared by

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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 previous status report INDC(NDS)-0421 published in March 2004 (available from: https://www-nds.iaea.org/publications/indc/indc-nds-0421-rev.1/), and defines the status of the NSDD Network as of May 2017.

May 2017

Contents

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, and on CD-ROM 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 in 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*. As of 2015, all mass chain evaluations are published in the *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 (nds.contact-point@iaea.org), and will be forwarded to the Scientific Secretary of the NSDD Network.

Co-ordination in the two-year interval between NSDD meetings is mainly accomplished through information exchange between network participants. The ENSDF manager (Elizabeth A. McCutchan: mccutchan@bnl.gov) co-ordinates all work related to the preparation of evaluations ENSDF and incorporation of horizontal evaluations into the ENSDF and is, furthermore, the editor of the related publications in the Nuclear Data Sheets. The IAEA Nuclear Data Section (contact Paraskevi Dimitriou: p.dimitriou@iaea.org) is the organizer of the biennial Network co-ordination meetings and is responsible for IAEA-sponsored workshops designed to train new and active nuclear structure and decay data evaluators, provides support to the network through coordination of targeted projects, 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 through the internet on a monthly basis (http://www.nndc.bnl.gov/ensarchivals/). 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 of 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 nuclear structure and decay data are compiled in ENSDF format soon after their publication by a group of network evaluators, coordinated by E.A. McCutchan (NNDC), and are incorporated into the experimental unevaluated data listing (XUNDL) maintained at the NNDC.

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

Both NNDC (BNL, Upton, USA) and NDS (IAEA, Vienna, Austria) provide global online access to ENSDF and NSR databases via the Worldwide Web (see Section 3 for more details). Users can easily retrieve data and download files available in different formats from the Internet.

2.3 Data files and libraries derived from ENSDF

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

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 can also be retrieved through online access.

2.4 Horizontal evaluations and parallel activities

Updating 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 Paraskevi Dimitriou, p.dimitriou@iaea.org). General co-ordination work between these meetings is provided by the ENSDF manager (E.A. McCutchan, mccutchan@bnl.gov).

3. Web access to major databases

NNDC/BNL, Upton, USA and NDS/IAEA, Vienna, Austria (see below for details) provide access to ENSDF and NSR through the Web. The two data 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.

National Nuclear Data Center
Contact person: Alejandro Sonzogni
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: sonzogni@bnl.gov
Web: http://www.nndc.bnl.gov

International Atomic Energy Agency - Nuclear Data Section
Contact person: Arjan Koning
Address: Wagramerstrasse 5, PO Box 100 A-1400 Vienna, Austria
Telephone: +43 (1) 2600-21709
Fax: +43 (1) 26007
E-mail: a.koning@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 = 2 − 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) has now been replaced by the Nuclear Data Group at LBNL and University of California at Berkeley (UCB). 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, is still available, offering interactive Web access and the display of ENSDF. However, it is not maintained and does not include the latest ENSDF database.

4. Data available on-line and off-line

Nuclear structure data for mass chains and separate isotopes with A < 20 have until 2015 been published in the journal *Nuclear Physics A*, and incorporated into ENSDF by NNDC staff. As of 2015, they too are published in *Nuclear Data Sheets*.

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. An Update to the 8th edition of the "**Table of Isotopes"** was published in 1999.

"Nuclear Wallet Cards" is published by NNDC (8th edition, 2011). This publication summarises the ground- and metastable-state properties of nuclei, and is also available in HTML, PDF and PostScript formats online (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 the 16th edition of their Wall Chart in 2002. KFK published the 9th edition of their Wall Chart in 2015.

Values for atomic masses, separation energies, and reaction energies are recommended by the Atomic Mass Evaluation (AME) project (Centre de Spectrometrie Nucleaire et de Spectrometrie de Masse/ Orsay, Institute of Modern Physics/ Lanzhou University, Argonne National Laboratory, RIKEN). Their latest adjustment was published in Chinese Physics C 41, (2017) 030002, 030003, replacing the previous evaluations published in Chinese Physics C 36/12, (2012) 1287 and Nucl. Phys. A279 (2003) 337. These mass adjustment data are available in ASCII-text format online from the Atomic Mass Data Center, http://amdc.impcas.ac.cn and http://amdc.in2p3.fr, with errata up to the present date. The ASCII-text files can also be found at http://www-nds.iaea.org and http://www.nndc.bnl.gov/

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 Chinese Physics C 41, (2017) 0300001 6, this publication replaces the previous evaluation published in Chinese Physics C 36/12 (2012) 1157. Data are also available in PDF or ASCII text format online from the Atomic Mass Data Center, http://amdc.impcas.ac.cn and http://amdc.in2p3.fr, and http://www-nds.iaea.org and http://www.nndc.bnl.gov/

NUCLEUS is a PC software package used to display **NUBASE** data that can be freely downloaded from http://amdc.in2p3.fr/ and http://www-nds.iaea.org . The software is currently being rewritten in Java and will be disseminated from the IAEA web server in addition to the AMDC web site.

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 (thermal and fission cross sections) from the ENDF/B-VII.0 database can be studied and extracted by means of this program.

LiveChart is a software package that allows the user to retrieve and plot nuclear structure and decay data from the ENSDF database interactively. In addition, this software package provides radiation information following nuclear decay (energy, intensity) as well as thermal neutron cross sections, charge radii, nuclear moments, and fission yields from databases that contain such data. Since it is based on MySQL language, it provides a wide range of search and filter options. All the data displayed online can be downloaded as CSV files.

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 developed by S.Y. Chu, L.P. Ekström and R.B. Firestone, is a Windows application to access and display nuclear data interactively and to search for literature references that is, however, no longer maintained.

Updated XGStandards contain updated 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 1998 to 2003 published in two volumes: Update of X Ray and Gamma Ray Decay Data Standards for Detector Calibration and other Applications, STI/PUB/1287-VOL 1 and STI/PUB/1287-VOL 2 (https://www-nds.iaea.org/publications/group_list.php?group=STI-PUB). These data replace the results of the previous CRP published as IAEA-TECDOC-619 (https://www-nds.iaea.org/publications/group_list.php?group=TECDOCS)

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.

The **Recommended Decay Data Library** is a collection of evaluated decay data for the main actinides used in nuclear reactor fuel cycles, nuclear waste management, nuclear material accounting techniques, as well as in nuclear physics and other non-energy applications. They are the results of an IAEA CRP from 2007 to 2011 that were published in STI/PUB/1618 (https://www-nds.iaea.org/publications/group_list.php?group=STI-PUB). The data can also be retrieved through the Web interface https://www-nds.iaea.org/act_ddl/.

Medical Portal is an online portal to all reaction and decay data relevant for the production of medical radionuclides. The data available through this web interface have been produced by a series of IAEA CRPs addressing data needs for established and emerging therapeutic and diagnostic radionuclides. The results of the most recent IAEA CRP on Charged-particle Monitor reactions and Medical Isotope Production (2012-2016) will be made available soon. The portal is available from https://www-nds.iaea.org/relnsd/vcharthtml/MEDVChart.html.

5. NSDD-related computer codes

Co-ordination of work on program development exists at the national level in the USA. Support is provided at an international level through a data development project coordinated by the IAEA. 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 R0, HF and theoretical $T\frac{1}{2}(\alpha)$ data
DELTA:	analyses angular correlation data
GABS:	calculates absolute $\Delta I\gamma$ data
GTOL:	determines level energies from a least squares fit to Eγ data and feedings
BRICC:	interpolates internal conversion coefficients, maintained by Australian National University Data Center
BRICCmixing:	calculates mixing rations of two gamma-rays with mixed multipolarities, maintained by Australian National University Data Center
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
JGAMUT:	produces adopted energy levels from fits to matrices of gamma-ray energies
RadD:	estimates the α R_0 parameters by interpolating between the values of neighboring even-even nuclides using the tables of Alkovali (1998). This code has now been embedded in the ALPHAD code

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.
JAVA-NDS:	produces a printable output of the ENSDF file for publication and for web display
AVETOOLS:	combines three different statistical methods to calculate averages of experimental data with uncertainties, maintained by Australian National University Data Center
V.AveLib:	determines a recommended value for a measured quantity based on a sequence of measurements. Eight different averaging methods are available.The tool can also be used to identity outliers

These NSDD analysis and ENSDF utility codes, with the exception of AVETOOLS and V.AveLib require the input data to be in ENSDF format. Most of the codes are available in ANSI-77 FORTRAN, Compaq/Digital Visual FORTRAN (WIN95/98/00/NT/XP), Linux, and MAC OS from the NNDC and NDS Web sites. Some of the new codes (V.AveLiv, JGAMUT, Java-NDS) are written in Java language and require a Java Runtime Environment to be able to run on a PC. The latter can be downloaded free-of-charge from the Web. 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 and https://www-nds.iaea.org/public/ensdf_pgm/index.htm.

5.4 MyEnsdf Web Tool

A Web interface allowing the user to upload an ENSDF file and run it through the ENSDF analysis and Utility codes on the web server has been developed by V. Zerkin (v.zerkin@iaea.org) and is available at https://www-nds.iaea.org/exfor/myensdf.htm. Apart from the convenience of not having to download, install and compile the codes on a PC, this tool also offers the user continuous access to up-to-date working versions of the ENSDF codes.

Curently, the codes available on MyEnsdf Web Tool are:
- ALPHAD, LOGFT, RULER, GTOL, BRICC, BRICCmixing, GABS, RADLST
- FMTCHK, PANDORA, XPQCHK

In addition, several codes developed by the PNPI Data Center have also been made available:
- chk_ENSDF, newGTOL, BARON

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. Conditions for joining or leaving the Network are being reviewed *(to be discussed at this meeting)*

Table 1. ENSDF data evaluation centres, their mass-chain evaluation responsibilities and other activities, May 2017.

Data Centre	Mass Chain Responsibility/Activity
National Nuclear Data Center Brookhaven National Laboratory P.O. Box 5000 Upton, NY 11973-5000, USA Contact: E.A. McCutchan	A-Chain Evaluations: 45-50, 60-73 (ex 62-64,67), 82-88 (ex 83),94-97,99,113-116, 136-148,150,152-165 (ex 164),180-183,189,230-240,>249 Data Dissemination Maintenance of the Evaluated Nuclear Structure Data File (ENSDF) and Experimental Unevaluated Nuclear Data List (XUNDL) and editorship of the Nuclear Data Sheets Maintenance of the ENSDF analysis and utility programs

Data Centre	Mass Chain Responsibility/Activity
Nuclear Data Project Oak Ridge National Laboratory Oak Ridge, TN 37831, USA Contact: M. Smith	A-Chain Evaluations: 241-249
Nuclear Data Group Lawrence Berkeley National Laboratory and University of California at Berkeley Berkeley, CA 94720, USA Contact: L. Bernstein	A-Chain Evaluations: 21-30,81,83,90-93,166-171,184,186,187,191-193,210-214 Data Dissemination
Triangle University Nuclear Laboratory Duke University Durham, NC 27706, USA Contact: J.H. Kelley	A-Chain Evaluations: 2-20 Data Dissemination
Argonne National Laboratory Bldg. 208/C-163 9700 South Cass Avenue Argonne, IL 60439-4815, USA Contact: F.G. Kondev	A-Chain Evaluations: 106-112,175-179,199-209
Michigan State University 640 S. Shaw Lane East Lansing, Michigan 48824 Contact: J. Chen	A-Chain Evaluations: 31-44
Texas A&M University College Station TX 77845-3366, USA Contact: N. Nica	A-Chain Evaluations: tbd
Indian Institute of Technology Department of Physics, Roorkee Uttaranchal 247667 India Contact: A.K. Jain	A-Chain Evaluations: 215-229
Nuclear Data Centre Petersburg Nuclear Physics Institute (PNPI) Academy of Sciences of Russia Gatchina, Leningrad Region 188 350, Russia Contact: I.A. Mitropolsky	A-Chain Evaluations: 130-135,146
Institute of Atomic Energy P.O. Box 275 (41), Beijing People's Republic of China Contact: G. Zhigang	A-Chain Evaluations: 51,62,195-198
Department of Physics Jilin University, Changchun 130023 People's Republic of China Contact: H. Junde	A-Chain Evaluations: 52-56,63,67
Japan Atomic Energy Agency Research Group for Applied Nuclear Physics Tokai-mura, Ibaraki-ken 319-1195, Japan Contact: Hideki Iimura	A-Chain Evaluations: 120-129
Department of Physics and Astronomy McMaster University Hamilton, Ontario L8S 4M1 Canada Contact: B. Singh	A-Chain Evaluations: 1,64,74-80, 89,98,100,149,151,164,188,190,194
Department of Nuclear Physics Australian National University Canberra ACT 0200, Australia Contact: T. Kibedi	A-Chain Evaluations: 172 - 174 Maintenance of the BrIcc data base and related software

Data Centre	Mass Chain Responsibility/Activity
Institute of Nuclear Research Hungarian Academy of Sciences Bem ter 18/c, P.O. Box 5 4001 Debrecen, Hungary Contact: J. Timar	A-Chain Evaluations: 101 - 105
National Institute of Physics and Nuclear Engineering "Horia Hulubei" Str. Reactorului no.30, P.O.BOX MG-6, Bucharest - Magurele, ROMANIA Contact: A. Negret	A-Chain Evaluations: 57-59, 117-119

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

Table 2. Centres with horizontal evaluation activities Update Table 2.

Group	Material
Alkovali/ORNL	Tables of Nuclear radius parameters calculated using the Preston Formula for α decay probabilities
G. Audi/CSNSM, M. Wang/Lanzhou Univ, F. Kondev/ANL, S. Naimi/RIKEN	AME+NUBASE (Evaluated atomic masses, ground-state and isomeric state properties)
B. Singh/McMaster Univ., B. Pritychenko/NNDC	B(E2) Evaluations
IAEA CRP coordinated by B. Singh	Evaluation of Beta-Delayed Neutron Emissoin Probabilities and Half-Lives for Z=2-28
B. Pritychenko/NNDC	Double beta decay
R. Firestone/LBNL-UCB	Evaluated Gamma-ray Activation File
T. Kibedi/ANU	Electric monopole transitions between 0^+ states for nuclei throughout the periodic table
B. Singh/McMaster Univ.	Compilation of directly measured nuclear spins of ground states and long-lived isomers
F. Kondev/ANL	K Isomers
A.K. Jain/IITRoorkee, B. Singh/McMaster Univ.	Atlas of Nuclear Isomers
B. Singh/McMaster Univ.	Review of Logft Values in β Decay
N.J. Stone	Tables of Nuclear Magnetic Dipole and Electric Quadrupole Moments
N.J. Stone	Table of nuclear electric quadrupole moments
B. Singh/McMaster Univ.	Table of Superdeformed Bands and Fission Isomers

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 (AGM) 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. *(to be discussed at this meeting)*

An IAEA Network 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)".*