INTERNATIONAL ATOMIC ENERGY AGENCY

NUCLEAR DATA SERVICES

DOCUMENTATION SERIES OF THE IAEA NUCLEAR DATA SECTION

IAEA-NDS-167
January 1995

FENDL/D-1.0

Decay Data Library for Fusion Applications
Version 1 of January 1992

Summary documentation by

A.B. Pashchenko

Abstract: This document describes the FENDL/D-1.0 decay data library which is the sublibrary of FENDL, the evaluated nuclear data library for fusion applications. The FENDL/D-1.0 was generated by merging data from ENDF/B-6 and from ENSDF (version of May 1990) and contains the basic information for approximately 2900 nuclides and isomers needed for general activation calculations. The data are available from the IAEA Nuclear Data Section online via INTERNET by FTP command, or on magnetic tape upon request.

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username: NDSOPEN for FTP file transfer

Note:

The IAEA-NDS-documents should not be considered as publications or reports. When a nuclear data library is sent out by the IAEA Nuclear Data Section, it will be accompanied by an IAEA-NDS-document which should give the data user all necessary information on contents, format and origin of the data library.

IAEA-NDS-documents are updated whenever there is additional information of relevance to the users of the data library.

For citations care should be taken that credit is given to the author of the data library and/or to the data center which issued the data library. The editor of the IAEA-NDS-document is usually not the author of the data library.

Neither the originator of the data libraries nor the IAEA assume any liability for their correctness or for any damages resulting from their use.

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Citation guideline:

This data library should be cited as follows:

> A.B. Pashchenko, "FENDL/D-1.0. Decay data library for fusion applications", report IAEA-NDS-167 (IAEA Jan. 1995). Data library retrieved online (or: received on tape) from the IAEA Nuclear Data Section.

FENDL/D-1.0
Decay Data Library for Fusion Applications
Version 1.0 of January 1992

The FENDL/D-1.0 is sublibrary of FENDL, the evaluated nuclear data library for fusion applications. This file was supplied to the IAEA/NDS by F.M. Mann (F.M.Mann, Private Communication, January 22, 1992), following the recommendation of the IAEA Advisory Group Meeting on 'FENDL-2 and Associated Benchmark Calculations', held in Vienna from 18 to 22 November 1991, report INDC(NDS)-260.

The FENDL/D-1.0 was generated by merging data from ENDF/B-6 and from ENSDF (version of May 1990) and contains the basic information for approximately 2900 nuclides and isomers needed for general activation calculations:

- Nuclide
- Half-life
- Number of decay modes
- Fractions of decay in each decay mode (branching ratio)
- Decay daughter nuclide in each decay mode
- Gamma-ray intensity and energy spectrum in each decay mode

(Currently 21 energy groups, not consistent with the FENDL gamma-ray group structure which is 42)

The data are in ENDF-6 format and have passed the tests in CHECKR. The ENSDF data were converted in ENDF-6 format by using the program MEDLIST.

FENDL/D-1.0 decay data library are available as data file

'MANNDD.DAT'

in the NDS open area 'FENDL' under the subdirectory

'[FENDL.FENDLD]'

It has a size of 27 Megabytes.

Additional information on the decay data files may be obtained from

Dr. F.M. Mann
Westinghouse Hanford Company
Mail Stop HO-36, P.O.Box 1970
Richland, WA 99352
U.S.A.
Fax: 1-509-376-1293
Phone: 1-509-376-5728
E-mail: u1635@c.nersc.gov

IMPROVEMENTS TO THE DECAY DATA LIBRARY AND THE FEASIBILITY OF PREPARING PROCESSED FILES

The status and possible improvements to the FENDL decay data library were discussed at the IAEA Advisory Group Meeting on 'Improved Evaluations and Integral Data Testing for FENDL' held in Garching, Germany, from 12 to 16 September 1994, report INDC(NDS)-312. It was noted that there is no standardised processed decay data files because the needs of each inventory code are rather different. It was proposed that E.T.Cheng should organize a subgroup to consider the feasibility of preparing processed files and should look at ways of comparing the existing libraries. The status report by E.T.Cheng is given in Appendix.

For any clarifications/suggestions, please contact

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Appendix

Date: December 7, 1994

To: Distribution
From: E.T. Cheng, TSI Research
Subject: **Decay Data Library for FENDL**

Gentlemen:

I have investigated the decay data library provided by Dr. Fred Mann for FENDL activation applications. The file contains the basic information needed for general activation calculations:

1. Isotope
2. Half-life
3. Number of decay modes
4. Fractions of decay in each decay mode (branching ratio)
5. Decay daughter isotope in each decay mode
6. Gamma-ray intensity and energy spectrum in each decay mode

(Currently 21 energy groups, not consistent with the FENDL gamma-ray group structure which is 42)

The activity and decay gamma-ray will be fully disclosed if the above basic information is available. This will allow us to calculate:

(1) the waste disposal ratings (if based on specific activity limit), and

(2) biological dose rate (either contact dose rate or dose rate at distances from a specified irradiated geometry).

Additional information will be needed for the following activation related quantities:

1. Afterheat - Decay beta energy and decay gamma energy, or the sum of both decay energies, and
2. Radiological Hazards - Various biological hazard coefficients.

For the FENDL activity to produce a globally acceptable working decay data library, we need to review and update the existing information in the FENDL decay data library, and install additional information into the FENDL system for afterheat and radiological hazards calculations.

I would welcome any suggestions and comments from all of you regarding what we should do in order to produce a globally acceptable working decay data library for FENDL.

Distribution:

Hosny Attaya, ANL
Robin Forrest, UK/AEA
S. Ganesan, IAEA/NDS
Yujiro Ikeda, JAERI
Jura Kopecky, ECN
Fred Mann, Westinghouse-Hanford
Anatoly Pashchenko, IAEA/NDS
Mohamed Sawan, UW-Madison

Attachment

DISTRIBUTION OF THE FENDL LIBRARY

(As recommended at the IAEA Advisory Group Meeting on FENDL,
held in Del Mar, California, 5-9 Dec.1995)

The master copy of the FENDL-1 library resides with the Nuclear Data Section of the International Atomic Energy Agency. To facilitate user access to the library the official copy of FENDL-1 was distributed in February 1996 to the major nuclear data centres in Europe (NEA Data Bank, Paris), Japan (JNDC, Tokai-mura), Russia (CJD,Obninsk) and USA (NNDC, Brookhaven and RSIC, Oak Ridge). As agreed between data centers, sharing common FENDL information, the recipients are receiving now the same products from all above centers. The data are available and may be further distributed to the user community according to the customer service options given below. Each FENDL sub-library will be in a single data set, i.e. Activation, Decay, etc. in the 8 mm tape, 6 mm tape, 4 mm tape or standard 9 track magnetic tape (6250 bpi or 1600 bpi) and CD-ROM options. The interested scientists may request FENDL-1 (or parts of it) directly from the IAEA/NDS or from one of these centers.

Table 1. FENDL CUSTOMER SERVICE OPTIONS

MEDIA	FORMAT	By WHOM
Electronic	FTP	IAEA, NEADB, NNDC
4 mm tape	UNIX TAR	CJD, IAEA, NEADB, NNDC, RSIC
	VAX BACKUP	CJD, IAEA, NEADB, NNDC
	ASCII	NEADB
6 mm tape	UNIX TAR	NEADB
	VAX BACKUP	NEADB
	ASCII	NEADB
8 mm tape	UNIX TAR	NEADB, NNDC, RSIC
	VAX BACKUP	NEADB, NNDC
	ASCII	NEADB
9 track	ASCII	CJD, IAEA
	EBCDIC	CJD, IAEA
CD-ROM	UNIX TAR	RSIC
	ASCII	NEADB

Table notes
1) NNDC will distribute FENDL unprocessed data
2) RSIC will distribute FENDL processed data
3) RSIC offers cost free service to ITER customers

FENDL SUMMARY

FENDL is the evaluated nuclear database for fusion applications. Its present version consists of the following sublibraries for which the documentation and the FTP subdirectory for online service are given below. At the ITER neutronics coordination meeting in San Diego, Feb. 1995, the ITER participants agreed to use FENDL in all design calculations.

1. **FENDL/A-1.1** (April 93): neutron activation cross-sections, selected from different available sources, for 636 nuclides, given in four representations:
   - FENDL/A: "point data", i.e. cross-sections as function of energy in ENDF-6 format (see IAEA-NDS-148, Rev. 2, Feb. 1995). FTP subdirectory: ACTIVATION.FENDLA
   - "MCNP": processed into the format for input to the MCNP Monte-Carlo transport code (see IAEA-NDS-168, Rev. 3, Feb. 1996). FTP subdirectory: ACTIVATION.PROCESSED.MCNP
   - "VITJ_E": VITAMIN-J 175 group data, processed for input to the code REAC*2/3 using the VITAMIN-E weighting spectrum (see IAEA-NDS-168, Rev. 3, Feb. 1996). FTP subdirectory: ACTIVATION.PROCESSED.VITJ_E
   - "VITJ-FLAT": VITAMIN-J 175 group data, processed using a flat weighting spectrum (see IAEA-NDS-148, Rev. 2, Feb. 1995). FTP subdirectory: ACTIVATION.PROCESSED.VITJ_FLAT
2. **FENDL/D-1.0** (Jan. 92): nuclear decay data for 2900 nuclides in ENDF-6 format, extracted from ENDF/B-6 and ENSDF (see IAEA-NDS-167, Jan. 1995). FTP subdirectory: DECAY.FENDLD
3. **FENDL/DS-1.0** (Oct. 93): neutron activation data for dosimetry by foil activation. This is identical with file 1 (neutron activation cross-sections) of the International Reactor Dosimetry File IRDF-90 version 2 of Oct. 1993 (see IAEA-NDS-141, Rev. 2, Oct. 1993), given as multigroup data in 640 group extended SAND-2 format, without covariance data. FTP subdirectory: DOSIMETRY.FENDLDS
4. **FENDL/C-1.0** (Nov. 91): data for the fusion reactions D(d,n), D(d,p), T(d,n), T(t,2n), He-3(d,p) extracted from ENDF/B-6 and processed (see IAEA-NDS-166, Jan. 1995). FTP subdirectories: FUSION.FENDLC and FUSION.PROCESSED
5. **FENDL/E-1.1** (Nov. 94): data for coupled neutron-photon transport calculations, including
   - a data library for neutron interaction and photon production for 63 elements or isotopes, selected from ENDF/B-6, JENDL-3, or BROND-2 (see IAEA-NDS-128, Rev. 2, Feb. 1996)
   - a photon-atom interaction data library for 34 elements taken from ENDF/B-6 (see IAEA-NDS-58, Rev. 4, Sept. 1994)

   These are available in three representations:
   - original ENDF-6 format, as above, with resonance-parameters where applicable. FTP subdirectory: TRANSPORT.FENDLE
   - "FENDL/MG" (March 95): VITAMIN-J 175 group data in GENDF and MATXSR format processed by NJOY using the VITAMIN-E weighting spectrum (see IAEA-NDS-129, Rev. 3, Feb. 1996). FTP subdirectory: TRANSPORT.PROCESSED.FENDLMG
   - "FENDL/MC" (March 95): processed into the ACE format needed for input to the Monte Carlo code MCNP4A (see IAEA-NDS-169, Rev. 3, Feb. 1996). FTP subdirectory: TRANSPORT.PROCESSED.FENDLMC

FENDL BENCHMARKS

The FENDL/BENCHMARKS subdirectory contains compiled fusion benchmark descriptions and data, provided by the international community of benchmark specialists, for validation of the above mentioned FENDL libraries.

INTERNET/FTP online access to FENDL files

The FENDL data files can be electronically transferred to users from the IAEA Nuclear Data Section online system through INTERNET. In the NDS open area 'FENDL', a subdirectory was created for each sublibrary. The subdirectory names are given above. The file transfer via INTERNET (unix system) can be performed by 'ftp' command to the address 'iaeand.iaea.or.at' or '161.5.2.2'. The user should logon to the foreign user name 'FENDL'. No password is required. After having logged on, the user can set the definition to any required subdirectory and transfer files as desired. A grand total of 47 (sub)directories with 810 files with total size of nearly 2 million blocks or about 1 Gigabyte (1 block = 512 bytes) of numerical data is currently available on-line.

(96/2/29; app. to 7, 128, 129, 148, 166, 167, 168, 169)