

Status of the JEFF-3 Project

June 2000

Background

The Joint Evaluated File (JEF) Project is a collaborative project involving member countries of the OECD Nuclear Energy Agency Data Bank. The Project was initiated in the early eighties with the aim of bringing together nuclear data evaluators and reactor physicists from Western European countries to co-operate on the production and validation of evaluated nuclear data libraries for fission reactor technology applications.

The first library, JEF-1, was produced in the mid-eighties. As validation studies showed that this first library needed improvements, it was decided to develop a second library, JEF-2. A preliminary version of JEF-2 was produced in 1990 and subsequently updated. A revised version, JEF-2.2, was created in 1992 then widely distributed and validated. The detailed contents of this library and the results of its extensive validation are summarised in the recently-released JEFF Report 17.

For some years, the European Fusion File (EFF) Project and the associated European Activation File (EAF), sponsored by the European Community Fusion Technology Programme, have developed in parallel to the JEF Project. Now the two projects, JEF and EFF, work closely together, producing joint evaluations in standard ENDF-6 format, sharing their validation results and holding joint meetings, with the purpose of producing together the JEFF-3 library.

A CD-ROM containing PC software called JEF-PC is available for visualising the JEF, EFF and EAF files, and producing plots. An upgraded version of this software, useable on Unix-operated computers, should be available in September 2000.

In addition to the files themselves, there exists an extensive documentation on both JEF and EFF in the form of electronic files (*pdf* format) available on line from the NEA Data Bank web server.

Motivation for JEFF-3

After years of validation studies covering thermal reactors, fast reactors, criticality and shielding benchmarks, it was established that the latest versions of the JEF and EFF files were of reasonably good quality. However, it was also found that the JEF-2.2 library suffered from several deficiencies and shortcomings, and was not capable of meeting the needs of new applications. In particular, it was found that significant improvements were required for the following materials : U-235 (epithermal capture), plutonium isotopes, minor actinides, U-233, Th-232, Pa-233, sodium, lead, structural materials (most notably Fe, Cr, Ni isotopes), fission yields and fission products, radioactive decay data, Li-7 and Be-9, neutron absorbers such as Hf, Gd or Er, and other nuclides. In addition, entire subsets of data were lacking, causing user insatisfaction : photon-production data for many nuclides, covariance information for most nuclides, and data for neutron energies ranging from 20 to 200 MeV (intermediate energies).

These findings motivated the decision to produce a new library, JEFF-3, with the double objective of correcting the known deficiencies of JEF-2.2 and of being more complete.

Status of the JEFF-3 library

The evaluation selection process for JEFF-3 began in 1997 by an extensive review of candidate evaluations, using as input the trends from available validation studies. In this selection process, it was decided to capitalise on the JEF-2.2 and EFF-2.4 validation work by giving preference to the JEF or EFF data whenever no other data could be proven to be of better quality.

In 1998, the NEA Data Bank began the compilation of an initial version of the library, JEFF-3T, with the objective of progressively completing, testing and upgrading this starter file until it could be officially released as JEFF-3.0.

General Purpose File

Compilation of the JEFF-3T General Purpose file was completed in 1999. This section subsequently underwent thorough testing at the NEA Data Bank according to recently-developed QA procedures. These procedures, which are still being extended, included running the BNL series of consistency checking codes on every evaluated data set.

Processing tests were carried out earlier this year on this JEFF-3T General Purpose file using NJOY 97.107, 97.108 and 99.05. These tests helped identify a few inconsistencies which had not been detected by the QA checks and which are currently being corrected.

Beginning in July 2000, a limited benchmarking of the file will be done by JEFF participants using some of the benchmarks used for the JEF-2.2 validation. Further internal benchmarking will take place in the next year and a half. During this time period, new or recently revised evaluations will be tested and considered for inclusion in the file, in place of the initial data. For example, recent fission product evaluations and EFF evaluations (Be-9, Ni-58, Ni-60, Fe-56) will be considered for inclusion in JEFF-3.0.

Special Purpose Files

The EFF project contributed the latest version of its comprehensive activation file EAF (currently EAF-99) as a JEFF-3T Special Purpose file. Work needs to be done on the ENDF format that will be used for distribution.

Significant efforts have been directed to the assembly of a new Decay Data file from the UKPADD-6 and UKHEDD-2.2 evaluations, with complements taken from NUBASE and ENSDF data converted into ENDF-6 format. This work began in 1999 and is now nearing completion. An updated Fission Yield starter file consistent with this new Decay Data file is being assembled from the UKFY3 evaluations. Both Decay Data and Fission Yield starter files should be ready for testing by August 2000. Extensions in the NEA Data Bank QA procedures, including energy balance checks using a revised version of FIZCON, are under study to cover these special purpose files.

The production of the JEFF-3T Intermediate Energy special purpose files has not started yet. Current plans are to produce JEFF-3 intermediate energy data with a new nuclear model code system named TALYS which is currently under development. The first operational version of this code system should be available in 2001. In the meantime, some tests are being performed which consist in deriving a set of consistent multigroup data covering the 0 to 200 MeV range from two separate evaluated files describing the data below 20 MeV and the data above 20 MeV.

Organisation and schedule

As described in the JEFF Project mandate, the Scientific Co-ordination Group (SCG), whose members are nominated by the Nuclear Science Committee Executive Group, has responsibility for the overall management of the Project.

There are currently five JEFF Working Groups performing technical work on :

- Benchmarking, Testing and Evaluation,
- Radioactive Decay and Fission Yield data,
- Fission Products,
- Intermediate Energy data,
- Fusion data (EFF group).

In addition, NJOY Users' group meetings are periodically held in conjunction with JEFF meetings.

Experimental data are provided by the Institute for Reference Materials and Measurements (IRMM) Geel and other laboratories.

The last meeting of the JEFF Project was held at the NEA Data Bank on May 22-24, 2000.

The Secretariat of the Project is the NEA Data Bank. As part of this task, the NEA Data Bank provides general information and maintains a list of actions relative to the JEFF Project. The NEA Data Bank also provides support for assembling, QA testing, maintaining, and distributing the libraries and the associated documentation, as well as for collecting user feedback.

The target date for the official release of the first version of the JEFF-3 library is 2002. Considerable effort is currently directed towards assuring that this library will be of high quality, internally consistent, as complete as possible and free of errors. Following this initial release, the various parts of the file will be completed and upgraded in subsequent versions. These updates will comply with well-defined QA rules. As with past JEF and EFF libraries, improvements of the JEFF-3.0 library will be guided by users' needs and feedback, as well as by the results of the benchmarking studies.