Overview of Nuclear Data Activities at the OECD Nuclear Energy Agency

Emmeric Dupont, Franco Michel-Sendis,
Jim Gulliford, Claes Nordborg

OECD Nuclear Energy Agency

Contents

1. Introduction – The OECD/NEA

➢ The NEA assists its Member countries in maintaining and developing, **through international co-operation**, the scientific, technological and legal bases required for the safe, environmentally friendly and economical use of nuclear energy for peaceful purposes.

➢ The NEA has 28 member countries, mainly in Europe, North America, and in the Asia-Pacific region.

Australia	France	Japan	Slovak Republic
Austria	Germany	Korea	Spain
Belgium	Greece	Luxembourg	Sweden
Canada	Hungary	Mexico	Switzerland
Czech Republic	Iceland	Netherlands	Turkey
Denmark	Ireland	Norway	United Kingdom
Finland	Italy	Portugal	United States

1. Introduction – The NEA Data Bank

➤ The NEA Data Bank is an **international centre of reference** for its member countries **with respect to basic nuclear tools** used for the analysis and prediction of phenomena in the nuclear field. It provides a direct service to its users by developing, improving and validating these tools and making them available as requested.

➤ The Data Bank has 22 member countries, mainly in Europe and in Asia.

Austria	France	Japan	Slovak Republic
Belgium	Germany	Korea	Spain
Czech Republic	Greece	Mexico	Sweden
Denmark	Hungary	Netherlands	Switzerland
Finland	Italy	Norway	Turkey
		Portugal	United Kingdom

1. Introduction – The NEA organisation

STEERING COMMITTEE FOR NUCLEAR ENERGY

Committee on the Safety of Nuclear Installations

Committee on Nuclear Regulatory Activities

Committee for Technical and Economic Studies
on Nuclear Energy Development and the Fuel Cycle

Radioactive Waste Management Committee

Committee on Radiation Protection and Public Health

Nuclear Law Committee

Nuclear Science Committee

NEA Data Bank

➢ Data Bank's responsibilities:

  ➢ Nuclear Data
  ➢ Computer Programs
  ➢ Benchmark Experiments

➢ Close collaboration with other parts of the NEA, especially the WPEC of the Nuclear Science Section.

2. The WP on Evaluation Cooperation

The NEA Working Party on international nuclear data Evaluation Cooperation (WPEC) successfully brings together world's major evaluation projects (ENDF, JENDL, JEFF) since 1989.

The main objectives of the WPEC are to:

➢ Promote the exchange of information on nuclear data measurements, evaluation, theory and model developments

➢ Improve the quality and completeness of evaluated nuclear data libraries

2. The WPEC Working Methods

The WPEC holds annual meeting to:

➢ Review progress in world's major evaluation projects

➢ Review progress in related measurement activities

➢ Identify common nuclear data issues

➢ Establish subgroups to address these issues

➢ Review progress of subgroups

Each subgroup publishes a reports, which are all available on line.

2. The WPEC Publications

Recent publications

➢ *Uncertainty and Target Accuracy Assessment for Innovative Systems Using Recent Covariance Data Evaluations* (Sg 26, Salvatores, 2008)

➢ *Evaluated Data Library for the Bulk of the Fission Products* (Sg 23, Oblozinski, 2009)

Accepted for publication (2010)

➢ *Covariance Data in the Fast Neutron Region* (Sg 24, Herman)

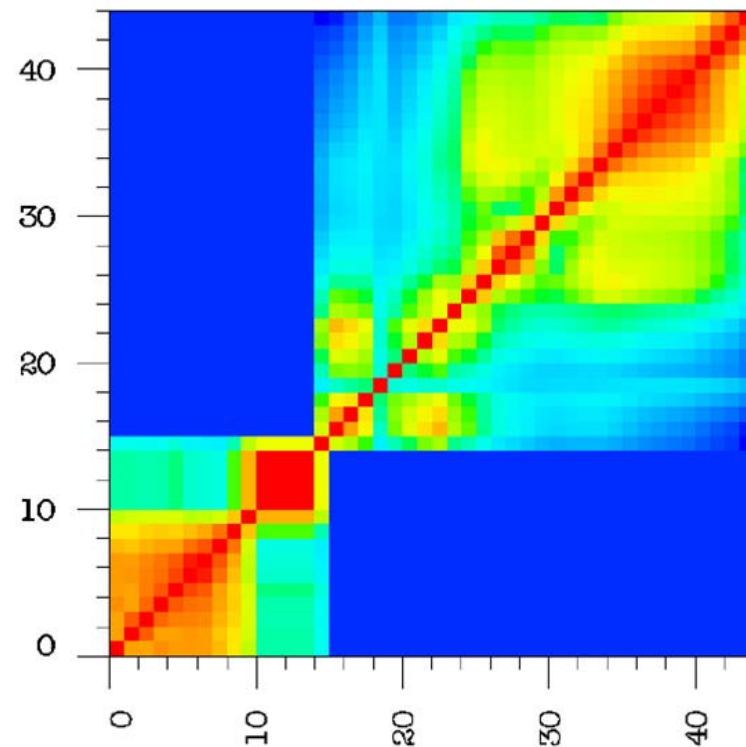➢ *Improvement of Accessibility and Quality of the EXFOR Database* (Sg 30, Koning)

2. The WPEC Subgroup 24 (completed)

Main objectives

- ➢ Methods for generating covariances in the fast energy region

- ➢ Implement covariance capabilities in the major nuclear reaction codes

Example of results

- ➢ Advantages and disadvantages of different methods have been examined and understood

- ➢ Methods proposed to avoid unreasonably low uncertainties

2. The WPEC Subgroup 30 (completed)

Main objective

Improve the accessibility and quality of the EXFOR experimental nuclear reaction database

Example of results

➢ Translation from the original EXFOR format to a computational format

➢ Verification of the computational database with statistical tests and comparison with TALYS results
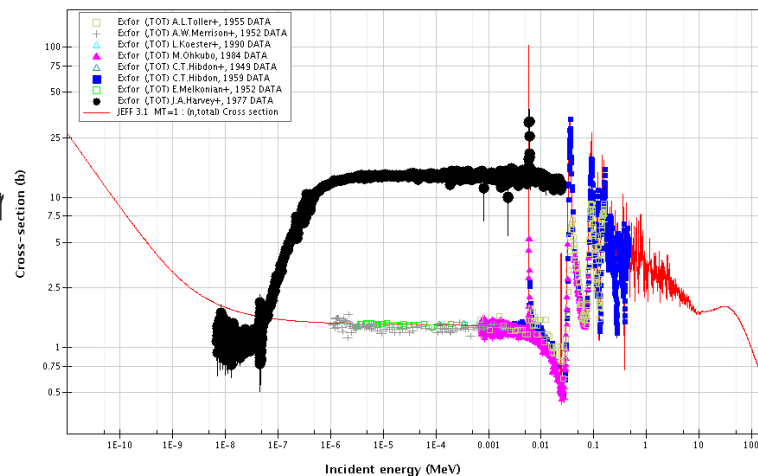
2. The WPEC Subgroups (completed)

Subgroup recently completed (publication expected in 2010 or 2011)

➢ Sg24 *Covariance Data in the Fast Neutron Region* (Herman)

➢ Sg30 *Improvement of Accessibility and Quality of the EXFOR Database* (Koning)

➢ Sg28 *Processing of Covariance Data* (Dunn)

➢ Sg27 *Prompt Photon Production from Fission Products* (Jacqmin)

➢ Sg29 *U-235 Capture Cross Section in the keV to MeV Energy Region* (Iwamoto)

➢ Sg32 *Unresolved resonance treatment for cross section and covariance representation* (Leal)

2. The WPEC Subgroups (active)

Ongoing Subgroups

➢ Sg C *High Priority Request List* (Plompen)

➢ Sg31 *Meeting nuclear data needs for advanced reactor systems* (Harada)

➢ Sg33 *Methods and issues for the combined use of integral experiments and covariance data* (Palmiotti, Salvatores)
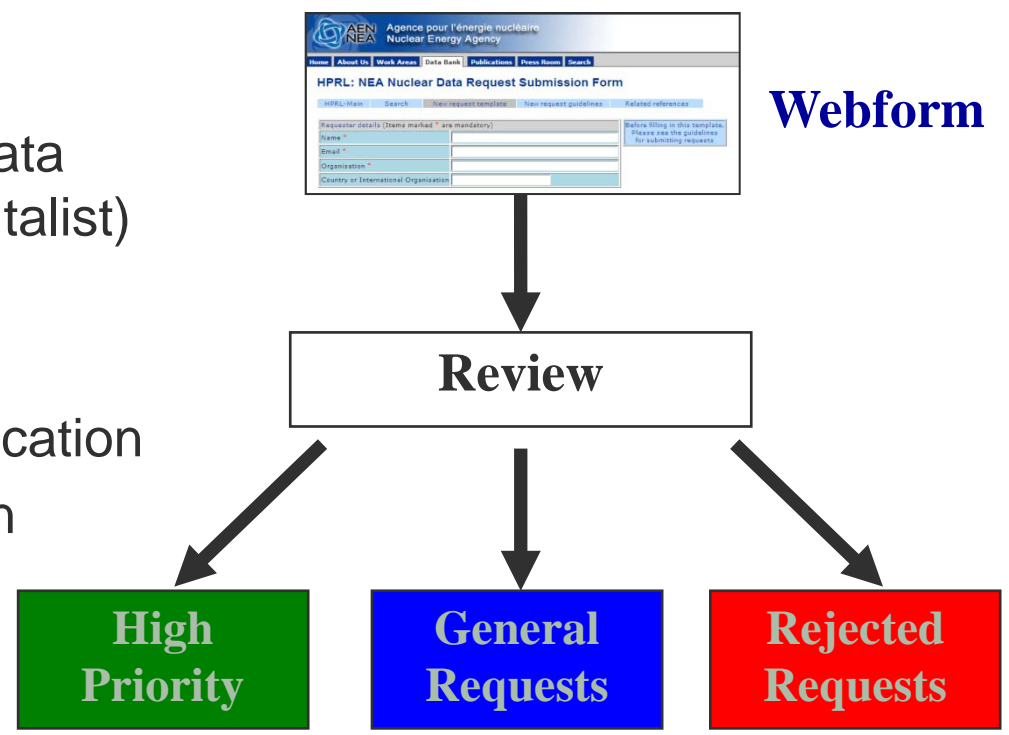
2. The WPEC Subgroup C (A. Plompen)

High Priority Request List

Long term Subgroup

Forum where data users meet data producers (evaluator, experimentalist)

Requests:

➤High priority: quantitative justification

➤General: qualitative justification

Webform

Review

High Priority   **General Requests**   **Rejected Requests**

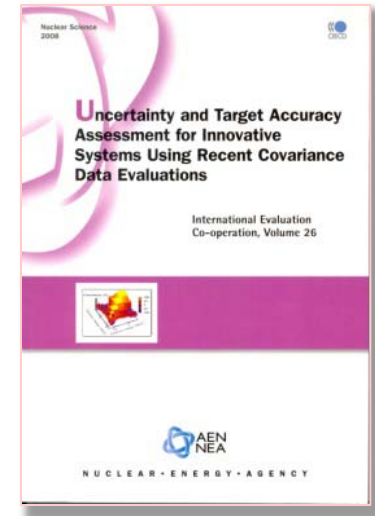# 2. The WPEC Subgroup 31 (H. Harada)

Meeting nuclear data needs for advanced reactor systems

Origin

Recommendations from Sg 26 on the data needs for advanced reactor systems

Tasks

➢ Consider the practicality of meeting these data needs

➢ Identify the correct path: evaluation vs. measurements

➢ Identify gaps in existing worldwide capabilities and recommend collaborative paths forward

# 2. The WPEC Sg33 (Palmiotti, Salvatores)

Methods and issues for the combined use of integral experiments and covariance data

Origin

Recommendations from Sg 26 on the data needs for advanced reactor systems

RZ model of a 600 MWe FBR core by JAEA

Tasks

➤ Assess the results of using a common set of integral experiments with different adjustment methodologies

➤ Impact of using different starting cross-sections and/or different covariance matrices will also be investigated
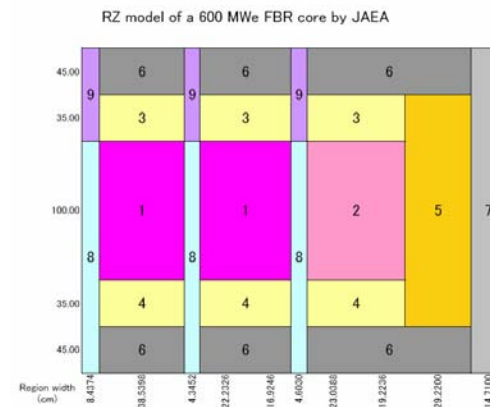
2. The WPEC Subgroups (new)

New Subgroups (started in 2010)

- ➤ Sg34 *Coordinated evaluation of ^{239}Pu in the resonance region* (de Saint Jean)
  - ➤ Solve discrepancies between differential and integral experiments
  - ➤ Provide new evaluation with covariance data

- ➤ Sg35 *Scattering angular distribution in the fast energy range* (Kawano)
  - ➤ Improve evaluation method of scattering angular distributions
  - ➤ Identify integral benchmarks where scattering data play important role

- ➤ Sg36 *Evaluation of experimental data in the resolved resonance region* (Schillebeeckx)
  - ➤ Use and preservation of experimental uncertainty/correlation for the analysis of the RRR and the processing into evaluations

3. The NEA Data Bank Services – Data

The Data Bank is one of the Core Centres (with NNDC for North America) of the international network of Nuclear Reaction Data Centres (NRDC).
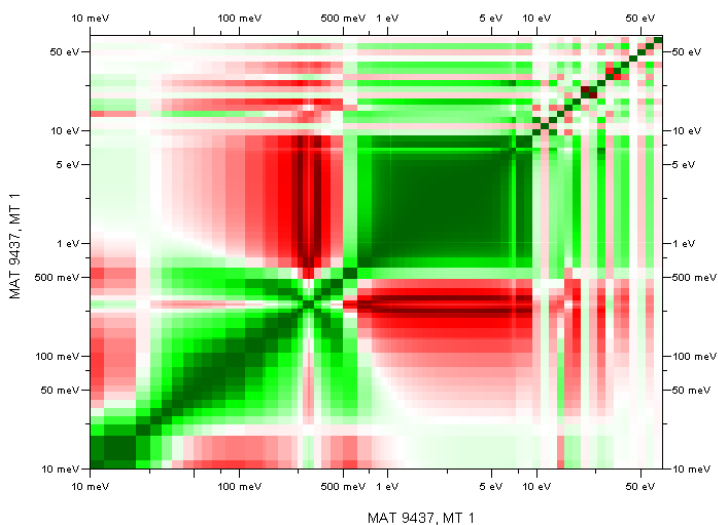
➢The services include the compilation and dissemination of evaluated data libraries, experimental data, bibliographic data;

➢As well as the development of display software to easily access to these databases;

➢The Data Bank is also responsible for coordination of the Joint Evaluated Fission and Fusion library (JEFF) project.

3. The NEA Data Bank Services – JANIS
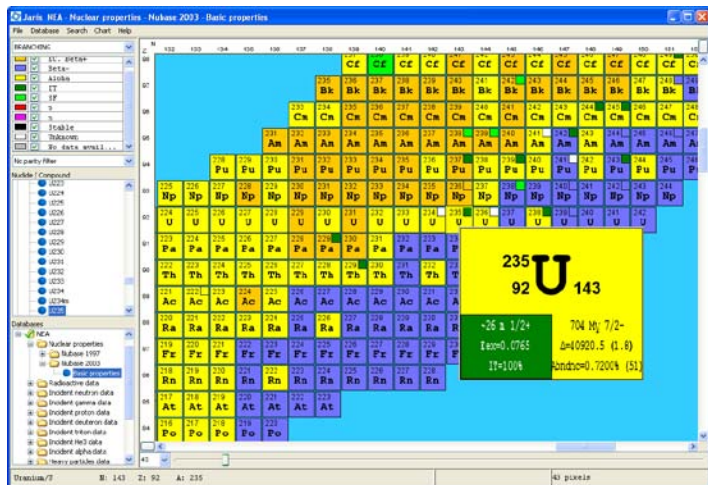
User-friendly tool to display, compute, and compare nuclear data.

- Search capabilities into evaluated, experimental, and bibliographic databases.
- Automated comparison of evaluated and experimental data
  - Cross sections,
  - Multiplicities (includes nu-bar),
  - Angular & energy distributions, also energy-angle distributions,
  - Decay data and fission yields.
- Covariance data in ENDF (MF33) and NJOY formats (BOXER).

3. The NEA Data Bank Services – Codes

The Data Bank operates a computer program service related to nuclear energy and radiation physics applications (similar to RSICC for North America).

➢The services include the collection of programs, compilation and verification in an appropriate computer environment.

➢The present collection contains more than 2000 documented packages and application libraries in various format (ACE…).

➢These materials are made available on CD or DVD, and via electronic transfer to about 900 nominated establishments in member countries.

3. The NEA DB Services – Benchmarks

The Data Bank compiles and makes available benchmark experiments for data and code validation of the Science program

➤ Criticality safety (ICSBEP) – 501 evaluations with benchmark specifications for more than 4 300 configurations.

➤ Reactor physics (IRPhE) – 43 evaluations of measurements performed at 24 different reactor facilities.

➤ Fuel performance (IFPE) – data for 1445 rods/sample of Zircaloy-clad UO_2 fuel irradiated in thermal reactors.

➤ Radiation shielding (SINBAD) – data for about 100 experiments relevant to fission/fusion reactor and accelerator shielding.

4. Summary

The NEA works as a

➢ A forum for sharing information and experience and promoting international co-operation;

➢ A centre of excellence which helps Member countries to pool and maintain their technical expertise.

The Data Bank provides its member countries with reference materials in the field of nuclear energy applications.

➢ Compilation/dissemination of nuclear data, integral benchmark experiments, as well as computer programs and associated application libraries.

➢ The Data Bank is responsible for the coordination of JEFF.