Availability of Research and Test Facilities for Fast Reactor Development

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Introduction (1)

As a result of economic situations and declining budgets in nuclear development in many OECD/NEA Member countries it is observed that numerous problems occur :

- for maintaining the present technical levels in the field of nuclear technology;
- In preserving existing integral data accumulated in the course of the nuclear development so far.

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Introduction (2)

In order to overcome these difficulties the NEA has initiated various activities:

- Workshop on R&D needs for current and future Nuclear Systems in November 2002;
- NSC is reviewing existing integral reactor physics data within the IRPhE (International Reactor Physics Experiments) evaluation project
- NDC has identified mechanisms and policies for promoting international collaboration in the area of nuclear education and R&D;
- CSNI has established an expert group to study "Support Facilities for Existing and Advanced Reactors (SFEAR)"

Introduction (3)

- It was concluded by the NSC that further discussions on R&D needs were essential to profit from the synergy of these studies;
- Therefore the NSC tasked an Expert Group in 2005 to seek and anticipate future needs of research facilities for R&D needs in Nuclear Science:
  - Based on the results of former studies;
  - In close collaboration with other NEA standing technical committees;
  - With the aim that the study should contribute to promoting international collaboration for the development of new nuclear technologies.

Mandate of the Expert Group

- Reviewing the status of research and test facilities worldwide and clarifying future needs of research facilities corresponding to the R&D needs in nuclear science and technology;
- Monitoring the NSC activities on preservation of existing integral reactor data, reactor characteristics and fuel cycle in order to identify the future needs in research facilities;
- Establishing recommendations on future needs of research facilities in nuclear science for international collaboration

Deliverables of the Expert Group

- Organise Expert Group meetings to review and exchange information on the status of integral data and needs for research and test facilities for future R&D in the field of nuclear science and technology.This work to be undertaken in close collaboration with CSNI and NDC;
- Establish a database of research and test facilities for R&D in the field of nuclear science and technology,and to clarify the status and the needs of these facilities;
- Produce a report on the status of integral data and the need of research and test facilities for the future R&D in nuclear science and technology.

The database (1)

- An initial "template" was defined containing 33 items of information to be collected for each facility;
- Entries were added from information derived from a number of sources:
  - from the members of the expert group themselves;
  - from the NuCoC database;
  - from the SFEAR report;
  - From the IAEA Research Reactor Database;
  - from the IAEA databases on Fast Reactors and ADS systems;
  - from the NuPECC Handbook;
  - from the NEA report on Lead Bismuth Eutectics;
  - from the members of the NEA Nuclear Science Committee.

The database (2)

- During 2006 a subsidiary project has developed a web-based version of the database;
- Because the database is intended for access by users around the world ,it was felt important that each entry was checked and agreed by the facility owners;
- The Research and Test Facilities Database (RTFDB) has grown over 700 checked records;
- The database was released to OECD-member countries on 20 July 2007;
- http://www.nea.fr/rtfdb/

The Report (1)

Structure of the report is based on the structure of the database :

- Based on “applications” rather than on “facility types”
- “Applications” consider topics such as Nuclear Data Measurements; Reactor Development; ADS; fuel,materials,etc…..
- “Facility types” such as accelerators, reactors, hot-cells, etc..are found in the sub-sequent sections as the applications for which they are used.

Report (2)

- OECD/NEA report on “future Research and Test Facilities needed in Nuclear Science and Technology” has been published in 2009;
- Is available through OECD/NEA;
- ISBN 978-92-64-99070-8

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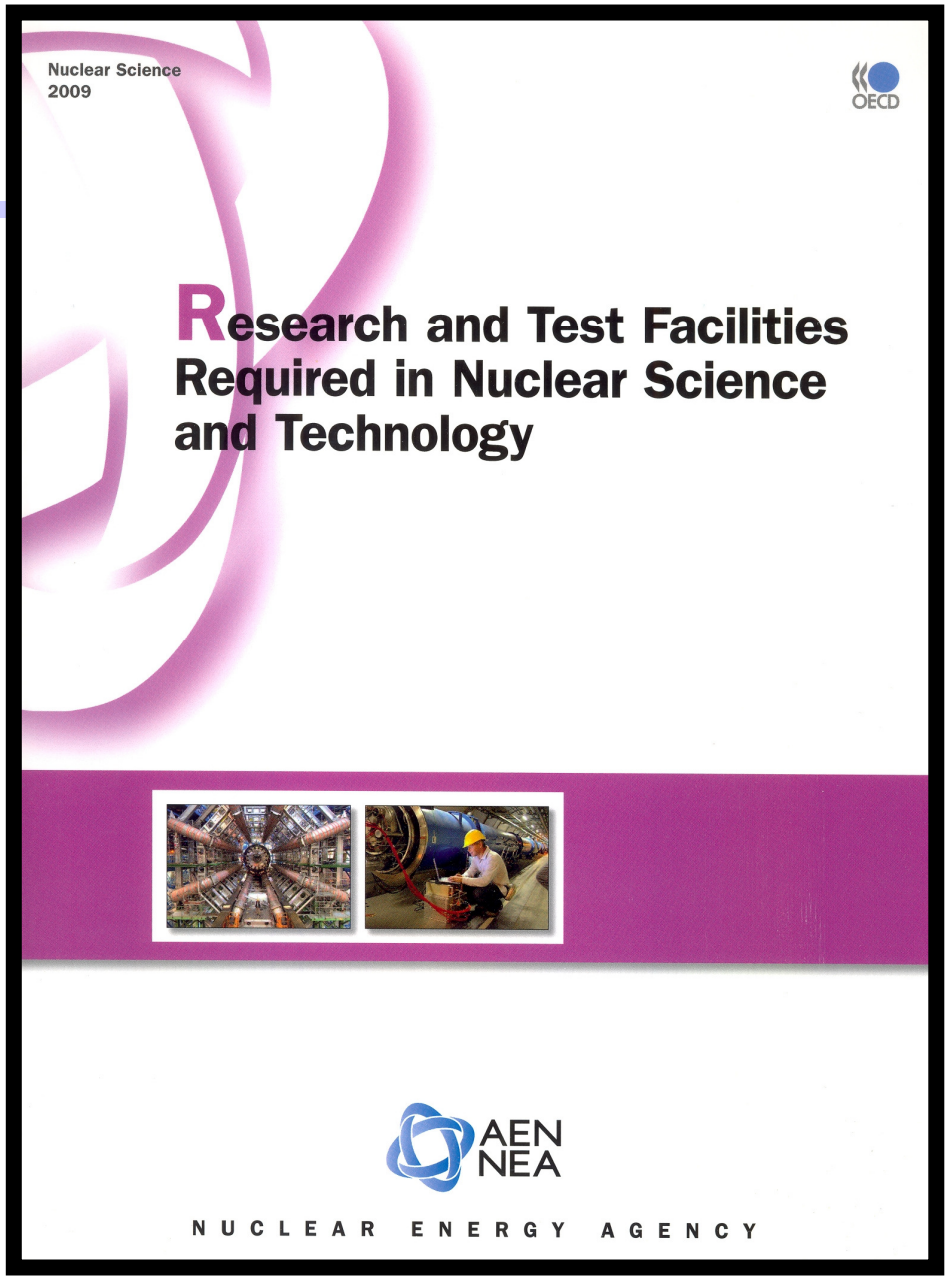

Report (3)

- The Expert Group classified the discussion of facilities on ***Applications*** using the same grouping as in the database;
- The main areas of consideration were:
  - Nuclear Data Measurements
  - **Reactor Development**
  - Neutron Applications
  - ADS and Transmutation Systems
  - **Fuel Research**
  - **Material Research**
  - Safety Research
- The areas in bold are those of most relevance to this conference

Reactor Development (1)

- It is evident that experimental validation of neutronics continues to be required;
- Interpretation of reactor physics experiments requires two components:
  - The data describing the basic underlying phenomena of the macroscopic system behaviour and
  - Computer codes to predict the macroscopic or integral effects.
- Essential to maintain,in addition to the integral facilities, facilities providing newly-required or improved basic data.
- Furthermore, it is essential to maintain and extend the Integral Reactor Physics Experiments (IRPhE) database in order to preserve former and new experimental data.

Reactor Development (2)

- The Expert Group remarked that :
  - many of the existing research reactors were put into operation in the 1960's and thus clearly ageing;
  - at the time of the report just 4 fast neutron research reactors were being operated worldwide;
  - In the mean time Phénix is shutdown but CEFR in China will diverge in 2010.
- Clear need for fast spectrum test facilities in the future:
  - France is considering the construction of ASTRID
  - Belgium is considering the construction of MYRRHA

The Expert Group

- Recommended that further federation of the financial,scientific and technical efforts of the OECD-countries could optimise available resources;
- Recorded its belief that OECD-countries could possible give a new impetus to the promotion of the relevant R&D in order to encourage innovation in the nuclear industry;
- Concluded that the GNEP partnership is an indication of the desire for increased collaboration within the international nuclear power community;
- Noted the key role played by international institutions ,such as OECD/NEA, EC and IAEA,in promotion of co-operation between countries.

Fuel Research

- The Expert Group noted the need for:
  - development of new facilities for GEN-IV conditions (high temperature,high fluxes,neutron spectrum,cooling type…) ;
  - maintaining the long term availability of hot-cells plus the associated facilities to undertake the necessary Post Irradiation Examination;
  - Maintaining and extending the International Fuel Performance Experiments (IFPE) database in order to preserve former and new experimental data.

- In relation to Fuel Cycle Chemistry the Expert Group further noted that:
  - a considerable effort is needed to scale-up the proposed partitioning processes to pilot scale and subsequently to industrial scale;
  - the strict regulations limiting the quantities of MA which can be handled in shielded facilities and the construction costs of facilities to fulfil the MA handling requirements is becoming a determining factor among P&T oriented countries.

Materials Research

- Study of structural materials for fast reactor systems are largely studied in the same type of installations as used for fuel.
- Similar conclusions/recommendations can be drawn.
- In addition the report also considers Liquid Metal Test Facilities:
  - in the past largely studied as reactor core coolants, for fusion energy blanket applications;
  - now also for ADS,spallation sources;
  - also for some GEN-IV reactor systems.
- In relation to LFR's as well as ADS systems, the importance was recognised of:
  - advanced materials for LBE applications and;
  - thermo-hydraulic studies on LBE systems

Conclusions

- Expert Group on "Needs of Research and Test Facilities in Nuclear Science" was set-up in 2005 under guidance of the NSC of the OECD/NEA.
- The Expert Group has produced :
  - A report : "Research and Test Facilities in Nuclear Science and Technology" which was published in the fall of 2009 and is available as an OECD/NEA publication (ISBN 978-92-64-99070-8)
  - The associated "Research and Test Facilities Data Base" was released to OECD-member countries on 20 July 2007 and contains 700 checked records and is openly consultable at: http//www.nea.fr/rtfdb/
- Part of this work is of importance "Fast Reactors and related Fuel Cycles".