NEA Research Activities:

Joint Safety Research Projects, Nuclear Science Programmes

Axel Breest Nuclear Safety Division,
Jim Gulliford Nuclear Science Division
NEA Committees

Steering Committee for Nuclear Energy

- CSNI: Committee on the Safety of Nuclear Installations
- CNRA: Committee on Nuclear Regulatory Activities
- RWMC: Radioactive Waste Management Committee
- CRPPH: Committee on Radiation Protection and Public Health
- NSC: Nuclear Science Committee
- NDC: Committee for technical and Economic Studies on Nuclear Energy Development and the Fuel Cycle
- NLC: Nuclear Law Committee

Executive Group of the NSC
(Data Bank Management Committee)
Joint Projects, Databases, Validation, Benchmarks, Sensitivity & Uncertainty Analysis, State-of-the-art reviews etc. etc.
NEA Programmes of Work

• Regular NEA Programme of Work defined through consensus agreement at NEA Steering Committee and Standing Technical Committees

• Alternatively, NEA Joint Projects provide a means for interested members and non-members to carry out specific research projects or scientific exercises on a cost-sharing basis
  – Executive Board of Joint Projects formed from representatives from funding countries/organisations
OECD/NEA Joint Projects

Motivations and Goals

• Resolve issues relevant for the nuclear community by means of research shared by many countries
• Enhance technical exchange, co-operation and consensus-building internationally
• Support the continued operation of unique test facilities which are of value to the nuclear community
• CSNI is committed to promote and facilitate Safety Research, through scientific and technical cooperation between member countries
• Availability of safety research results is a key element in assuring the high level and long-term safety of nuclear facilities
• Goal can only be reached if dedicated and sustained funding for safety research and the availability of experimental infrastructures is maintained
Cumulative Number of Projects to 2011

- Project Started
- Project Closed
Post 2011 OECD/NEA Safety Research Projects

Component Integrity
- PRISME
- PRISME2
- HEAF

RCS Thermal-Hydraulics
- PKL-2
- ROSA-2
- PKL-3
- ATLAS

Fuel Safety
- Halden
- SCIP2
- SCIP3
- CWL
- SFP

Containment issues
- HYMERES
- THAI2
- BIP-2
- STEM

Post Fukushima
- BSAF
- Advanced Reactors
- LOFC

S.A. Ex-Vessel
- SERENA

- Describes the achievements of the OECD/NEA Joint Projects on safety research carried out during the last three decades focused on:
  - thermal hydraulics,
  - fuel behaviour,
  - severe accidents.

- Demonstrate that the resolution of specific safety issues in these areas has greatly profited from Joint Projects.

- Highlights benefits from working together for maintaining unique experimental infrastructure, preserving skills and generating new knowledge.
Joint projects: Working Together (1)

Recognising the benefit of Joint Research Projects (JRPsov):

•  JRPsov have generated safety relevant programmes that may have never happened if the individual countries had been left alone with maintaining and operating a large facility

•  The time scale of JRPsov including preparation, contract building, programme execution, data treatment, and reporting takes typically several years. Therefore, JRPsov are mostly useful for dealing with mid-term or long term issues.

•  A new generation of experts are participating in key R&D areas and new countries are entering the nuclear arena.

•  JRPsov can contribute significantly to knowledge transfer and for building expert capability.
Joint projects: Working Together (2)

Sharing experimental infrastructure:
• Cost saving by pooling of resources
• Sustains funding for key facilities
• Sustains long-term availability of experimental knowledge and expertise
• Provides data to support independent safety assessment of partners

Procedure for establishing and conducting a Project:
• The Halden Project (1958) had a pilot function for establishing and managing a successful international project in reactor safety.
• In 2002, general guidelines for initiating, financing and managing projects were issued, leaving a large degree of flexibility to the individual project; these guidelines have led inter alia to a standard form of OECD/NEA Agreement.
• NEA plays an essential role in the initiation phase and keeps helping the Project throughout its lifetime by giving administrative, advisory and technical support.
More Information…

NEA CSNI/CNRA Committee web page:

NEA Joint projects web page:

Completed “Joint Projects” data (after 3 years):
Nuclear Science-Data Bank Products & Services

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NEADB-NS Team

NEADB-NS Programme of Work, Products and Services
Main Areas of Work:

- reactor physics
- fuel cycle physics and chemistry
- criticality safety
- material science
- radiation shielding
Nuclear Science Committee (NSC)

Expert Group on Improvement of Integral Experiments Data for Minor Actinide Management (EGIEMAM-II)

Expert Group on Multi-physics Experimental Data, Benchmarks and Validation (EGMPEBV)

Expert Group on Accident-tolerant Fuels for LWRs (EGATFL)

Working Party on Scientific Issues of the Fuel Cycle (WPFC)
- Heavy Liquid Metal Technologies
- Fuel Recycling Chemistry
- Advanced Fuel Cycle Scenarios
- Innovative Structural Materials
- Innovative Fuels
- Benchmarking of Thermal-hydraulic Loop Models for Lead-alloy-cooled Advanced Nuclear Energy Systems

Working Party on Multi-scale Modelling of Fuels and Structural Materials for Nuclear Systems (WPMM)
- Validation and Benchmarks of Methods
- Multi-scale Modelling Methods
- Structural Materials Modelling
- Multi-scale Modelling of Fuels
- Primary Radiation Damage

Working Party on Nuclear Criticality Safety (WPNCS)
- Advanced Monte Carlo Techniques
- International Criticality Safety Benchmarks Evaluation Project
- Criticality Excursions Analyses
- Assay Data of Spent Nuclear Fuel
- Uncertainty Analyses for Criticality Safety Assessment

Executive Group of the NSC (Data Bank Management Committee)
- Databases and Scientific Services
- The Joint Evaluated Fission and Fusion File (JEFF) Project
- Task Force on the Future Programme of the NEA Data Bank

NEA joint project in the nuclear science area:
Thermodynamics of Advanced Fuels – International Database (TAF-ID) Project

Nuclear Science Publications
Shielding Aspects of Accelerators, Targets and Irradiation Facilities – SATIF-3.1
Workshop Proceedings, Nuclear Science, 11-13 September 2012

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Examples of Nuclear Science Publications related to Innovation

- Introduction of Thorium in the Nuclear Fuel Cycle
  - Short- to long-term considerations

- Review of Integral Experiments for Minor Actinide Management

- Potential Benefits and Impacts of Advanced Nuclear Fuel Cycles with Actinide Partitioning and Transmutation
New Activities

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Working Party on International Nuclear Data Evaluation Co-operation (WPEC)
  • High Priority Request List for Nuclear Data

Working Party on Scientific Issues of the Fuel Cycle (WPEFC)
  • Heavy Liquid Metal Technologies
  • Fuel Recycling Chemistry
  • Advanced Fuel Cycle Scenarios
  • Innovative Structural Materials
  • Innovative Fuels
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Databases and Scientific Services

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Nuclear Energy Agency

New Activities

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- Working Party on Scientific Issues of the Fuel Cycle (WPFC)
- Working Party on Criticality Safety (WPNCS)
- Working Party on Scientific Issues of Reactor Systems (WPRS)

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NEA joint project in the nuclear science area:
Thermodynamics of Advanced Fuels – International Database (TAF-ID) Project
Review of Experimental Needs and RTFDB

Identifying experimental needs...

- WPs/EGs/Joint Projects
- Databases
  - Experiments & benchmarks
  - V&V, Benchmarks, Standard Problems, UA
- RTFDB
  - Review of existing research and test facilities (RTF) in the world;
  - Goals and applications of RTF;
  - Description of experiments fulfilled;
  - Availability of experiments/benchmarks;
  - Future experimental programmes;
  - Availability of RTF for carrying out new experiments.

State-of-the-art reviews

ANALYSIS OF EXPERIMENTAL DATA NEEDS, NEW INTEGRAL EXPERIMENTS

Update to Research and Test Facility Database – RTFDB
Trends & challenges (1)

- A generation of experimentalists is retiring at the same time as a new generation of modellers are developing advanced methods (multiphysics & multiscale simulations).
  - need urgent transfer of knowledge to help steer development and provide experimental validation of new methods

- Development of fully coupled multi-physics simulations is accelerating Nuclear Science involvement in areas of fuel performance, materials science, thermal-hydraulics
  - historically nuclear science focus was neutronics modelling
  - will also bring (has brought) NS into closer contact with Safety Division activities
Trends & challenges (2)

• Generally it looks as though innovation in the nuclear industry will be strongly linked to taking advantage of new materials

• Identification (through multiscale modelling, for example) & Testing of new materials is likely to be a growth area

• Thermal-hydraulics models still contain a lot of empirical methods, which puts onerous demands on experimental validation and limits the range of applicability of our computer codes

• Key engineering challenge is in moving existing innovative designs/systems from the laboratory to industrial scale applications

• Expect further accelerations in R&D requirements over next 10 years related to industrial realisation of accident tolerant fuels, advanced waste management strategies etc. etc. ...