
WORKSHOP STATEMENT

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STATEMENT OF THE WORKSHOP ON “BUILDING MULTINATIONAL FUEL AND MATERIALS TESTING CAPACITIES FOR SCIENCE, SAFETY AND INDUSTRY”

4-5 October 2018, NEA Headquarters, Boulogne-Billancourt

Forward

The workshop on “Building Multinational Fuel and Materials Testing Capacities for Science, Safety and Industry” was organised by the NEA under the auspices of the NSC and the CSNI, in line with NI2050\(^1\), in order to develop a collective strategy for overcoming key challenges in the experimental support for advances in fuels and materials (F&M).

To achieve this, the workshop brought together and facilitated dialogue between regulatory bodies, safety and research organisations, and the nuclear industry. The dialogue contributed to the furthering of the participants’ vision for integrated F&M research that supports addressing emergent safety issues as well as the deployment of novel technologies.

This Workshop Statement represents the collective viewpoint of the participants and is intended to serve as a reference document for further activities in this field. It will be discussed within the Nuclear Energy Agency (NEA) bodies and widely distributed among the NEA community to inform the decision process in this field.

Executive Summary

The continued evolution of fuel and materials technology, fuel performance, optimisation of operational limits, material ageing, failure limits, etc. will require experimental evidence obtained from tests performed in fuel and materials research facilities. These facilities constitute a key piece of infrastructure for the demonstration of safe, reliable and efficient operation of Nuclear Power Plants (NPP), and for long-term operation strategies.

In this context, the NEA is launching a multilateral initiative to strengthen fuel- and material-related experimental capabilities for the benefit of a broad community of users. A core aspect of this initiative is to develop a coordinated approach for performing experiments using key experimental facilities around the world. This initiative has become even more relevant given the closure of the widely-used Halden test reactor in Norway after decades of invaluable service to the international community.

Discussions with various member countries have determined that it would be desirable to establish a multinational framework to open access to a diverse range of experimental

\(^1\) NI2050 is the NEA Nuclear Innovation initiative aimed at accelerating market deployment of nuclear innovations.
capabilities and to ensure that they are utilised in a co-ordinated, efficient and cost-effective manner that can address long-term needs.

The workshop participants confirmed the benefits of international collaboration for addressing the strategic F&M research needs of the nuclear sector and recommended that the NEA pursue the establishment of a co-ordinated international Framework under which Joint Experimental Programmes (JEEPs) could be proposed, reviewed and established. It was agreed that this Framework will aim to maximise the value of future experimental programmes, as well as that of legacy data, by systematically collecting and critically evaluating data, and by increasing the role of modelling and simulation and advanced instrumentation. It was proposed that this endeavour should be established as an international joint undertaking.

The NEA will engage all relevant stakeholders to create a multinational NEA Framework for In-pile Fuel and Material Testing, whose primary functions will be to provide organisational and technical expertise and assist Framework members in developing JEEPs. The Framework will be tailored to the needs of its potential members, offering the required flexibility to ensure greater value/cost from experiments and mitigate operational risk.

1. Introduction

1.1 The nuclear sector has benefitted from and relied upon International Joint Projects (JPs), including the Halden Reactor Project (HRP), created and managed under the auspices of the NEA, for experimental data to support a variety of needs. NEA JPs have been instrumental in sustaining research infrastructure in a time where fuel and material testing capacity worldwide has been in decline. Through years or decades of continued research activities through these projects, trusted and unique sources of experimental data have been established.

1.2 The status quo has been disrupted by the recent closure of key test facilities that provided critical experimental data for the nuclear sector. Their closures raise the question of how the community can address the lack of testing capabilities and capacity.

1.3 The continued evolution of F&M technology, fuel utilisation and optimisation will require experimental evidence obtained from tests performed in F&M test facilities. These facilities constitute a key piece of infrastructure for the demonstration of safe, reliable and efficient operation of NPPs and for the assessment of modified and/or long-term operation (LTO) scenarios. There is a need to transfer the fulfilment of those needs from previous JPs, such as the HRP, to new facilities.

1.4 Remaining infrastructure must be maintained and improved to meet the continuous needs of the nuclear sector and must offer a diversity of experimental capabilities that are utilised in a co-ordinated and cost-effective manner. This will require, amongst other things, multinational support via NEA joint undertakings.

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2 F&M test facility specifically refers in this document to a research reactor with the ability to perform neutron irradiation or transient tests.
2. **Need for integrated fuels and materials research**

2.1. Regulators, technical support organisations, safety and research bodies, and industry require F&M testing capacities on a continual basis and they have clearly stated that the availability of testing facilities, particularly for loss-of-coolant accidents (LOCA), reactivity-initiated accidents (RIA) and power ramps, is crucial.

2.2. The opinion was widely shared that, at the strategic level, F&M testing facilities will continue to be essential to:

- validate safety margins and test beyond failure to explore source terms in severe accident scenarios;
- demonstrate safety and operational performance of existing nuclear fuel technologies, both within normal and abnormal operation ranges, including plant life extension;
- perform fuel cycle optimisation and fuel performance optimisation;
- fully explore the performance of F&M up to and surpassing operational limits;
- develop advanced F&M, and determine their performance;
- collect data required for the development and validation of simulation tools and development of new tools tailored to more complex F&M structures;
- expand fundamental understanding of fuels and other materials;
- provide on-line measurement capabilities unavailable at commercial power plants;
- provide testing capacity to respond to evolving data needs triggered by requirements from utilities and/or safety institutions;
- obtain data to support long-term storage, transport and disposal needs.

2.3. The multinational framework approach has proven to be an effective means to address the types of issues listed above by way of being able to:

- obtain the best value from research infrastructures which have adopted service-oriented policies and a user facility approach;
- coordinate available capacities in order to fully address the needs of the international community, with access to facilities across borders;
- build consensus and consolidate knowledge, as a basis for shared standards;
- create the conditions that enable bilateral arrangements between facilities and end-users;
- ease the transport of fuels and accommodate export controls or other restrictions;
- facilitate the creation and transfer of prototypical samples from industry partners;
- trigger governments’ investments and decisions by developing evidence-based proposals that provide the necessary argument in the associated value;
- educate the future generation of experts and leaders through secondment programmes and other initiatives.

3. **Strategic recommendations**

3.1. To overcome the uncertainties resulting from the vacuum created by the closure of the Halden Boiling Water Reactor (BWR) and other key testing reactors, it is vital that the international community works to consolidate views on irradiation programmes and related testing infrastructure into a shared mid- and long-term vision and strategy that addresses the needs of the nuclear community, including industry, regulators, research centres and any public organisations involved in policy making, by:
• bringing together end-users and related stakeholders to decide and implement a sound and robust multinational irradiation programme;
• cataloguing and describing the experimental infrastructure worldwide that can address relevant short-term experimental needs or that is suitable for adaptation to provide long-term support;
• optimising the use of the available capacities to generate new experimental data that are nowadays more difficult to obtain, in part due to the decreased number of F&M facilities and increased constraints on those that exist today.

3.2. To maximise the value of experimentation, multinational programmes should:
• ensure irradiation, out-of-pile tests and post-irradiation examination;
• systematically preserve and consolidate legacy experimental data and data generated from new experimental campaigns;
• review experimental data already obtained, quantifying uncertainties insofar as this is possible and the data are available;
• evaluate, peer-review and collect existing and new experimental results in a high-quality information system. Such a system can benefit from NEA’s considerable experience in the area of data preservation and relational database implementation and modernisation;
• apply state-of-the-art knowledge and a systematic approach to designing experiments and optimising experimental campaigns;
• use modelling and simulation as a tool for optimising the design and the implementation of experimental campaigns and adding value to the experimental data obtained;
• develop and deploy effective instrumentation and measurement systems;
• link with the HRP Board of Management to foster the preservation of the assets already generated by the HRP.

3.3. From a long-term perspective, it is necessary to:
• continue to address the experimental needs in the field of F&M irradiation;
• discuss the investments necessary for enhancing the experimental capability and capacity of both existing and new F&M test facilities and optimising their complementarity;
• ease the implementation of irradiation programmes relying on available capacities to meet the current and anticipated future needs and to sustain a multinational programme that opens the pathway for bilateral programmes.3

3.4. The industry requests that operators of F&M research facilities consider and develop pathways for making testing capabilities available within the coming years and maintain them for longer-term use.

3 In addition to providing a predictable source of financing, the HRP facilitated the creation of a stable partnership between the facility and its users, through the invention of two parallel entries: the HRP itself, co-financed by many countries under the auspices of the NEA, and the so-called bilateral projects, each one contracted with a single user and paid for by such user. This unique and valuable JP was made possible due to the support of government. The tests for the JP and for the bilateral projects were, in most cases, run in parallel. The synergy between the JPs and the bilateral projects has made the technological fortune of the Halden BWR, generating a solid technical basis through continued and deep interaction with the industry, the safety bodies and the R&D centres around the world.
3.5. It was acknowledged that a clear and collective agenda, developed in a multinational framework, for the utilisation of testing infrastructures will be instrumental in getting the support of relevant stakeholders to these pathways.

4. Establishing a new NEA Framework for In-pile Fuel and Material Testing

4.1. NEA will engage all relevant stakeholders to address the above needs and considerations, and to develop a proposal for a new Multinational NEA Framework for In-pile Fuel and Material Testing to complement the existing NEA JPs.

4.2. The Framework will be tailored to the needs of its potential members, offering the required flexibility to ensure greater value/cost from experiments and mitigating operational risk. It will provide organisational and technical expertise, in order to:

- enable a 'helicopter view' of international F&M testing facilities;
- co-ordinate needs and capabilities;
- connect experiments and data with state-of-the-art simulation and modern data management technologies;
- provide the stability required for investment decisions necessary to ensure availability of testing capacities in the future;
- facilitate marketing of international F&M testing capacities;
- offer a forum to raise issues in sample transport and waste management and a platform to build the relationships and confidence required for strong bilateral engagements;
- identify opportunities for cross-cutting activities that support F&M testing, e.g., instrumentation, modelling and simulation;
- improve the preservation and quality management of experimental data;
- facilitate professional development and educational opportunities;
- enable the establishment of JEEPs that may be proposed by Framework members.

4.3. It was agreed that the community should avoid discontinuities in F&M testing and maintain momentum with a prompt Framework Agreement that is developed in parallel to JEEPs based on the most mature proposals.

4.4. The NEA is currently engaging on both fronts, developing agreements to connect parties interested in the current experimental proposals while drafting the new Framework Agreement.