



OECD Nuclear Energy Agency

Nuclear Science Committee

Workshop on the need for integral critical experiments with low-moderated MOX fuels

14-15 April 2004
OECD headquarters
Château de la Muette
2, rue André Pascal, Paris 16
<http://www.nea.fr/html/science/meetings/mox>

Final announcement

Introduction and scope of the workshop

The use of MOX fuel in commercial reactors is a means of burning plutonium originating from either surplus weapons or reprocessed irradiated uranium fuel. This requires the fabrication of MOX assemblies on an industrial scale.

The OECD/NEA Expert Group on Experimental Needs for Criticality-Safety has highlighted MOX fuel manufacturing as an area in which there is a specific need for additional experimental data for validation purposes. Indeed, integral experiments with low-moderated MOX fuel are either scarce or not sufficiently accurate to provide an appropriate degree of validation of nuclear data and computer codes. New and accurate experimental data would enable a better optimisation of the fabrication process by decreasing the uncertainties on the determination of multiplication factors of configurations such as the homogenisation of MOX powders.

In this context, the OECD/NEA Nuclear Science Committee is organising a workshop to address the following topics:

- 1) Expression and justification of needs for critical or near critical experiments with low-moderated MOX fuels
- 2) Proposals for experimental programs to address these needs
- 3) Prospects for an international co-operative program

Organising Committee

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Workshop secretariat

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Key dates

March 15, 2004: Deadline for submission of full papers

March 26, 2004: Deadline for registration

Proceedings

The full papers will be included in the proceedings of the workshop, which will be published shortly after the meeting.

Presentations

Presentations can be made using overhead or video projectors. In the latter case, the file (preferably MS PowerPoint file) should be sent by e-mail to the secretariat before the meeting.

Registration and practical information

The participation is free of charge. However, a registration is required before March 26, 2004 (see the on-line registration form at <http://www.nea.fr/html/science/meetings/mox>).

Practical information including an access map to the OECD headquarters and a list of hotels is available on the workshop web site. Please note that an identity card bearing a photograph is required to access the OECD premises.

Session description

Session 1: MOX Fuel Fabrication – Design, Industrial Experience and associated Criticality-Safety issues

The purpose of this session is to familiarise the audience with the MOX fuel fabrication process and to present an industrial perspective in terms of feedback from existing facilities and challenges associated with new projects. The second part of the session will focus on criticality safety issues that are encountered at various phases of the MOX fabrication process and highlight areas in which the process could be better optimised if criticality safety margins were better known.

Session 2: Experimental Data Needs

The OECD/NEA Expert Group on Experimental Needs for Criticality-Safety has highlighted MOX fuel manufacturing, as an area in which there is a specific need for additional experimental data for validation purposes.

The purpose of this session is to establish the technical basis for the stated need. A link should be established between specific applications within the MOX fuel cycle and the lack of data to validate codes and cross section libraries that are used to establish the criticality safety basis for the application.

Session 3: Proposed Programs and Presentation of Experimental Facilities

The need, highlighted by the OECD/NEA Expert Group, focuses on the following parameters:

Reactor-grade plutonium

PuO₂ content: 30 % (Primary blend)
12.5 % - 5% (final blend)

Powder density: 4.6 g/cm³ and 5.5 g/cm³

Water content: 1 or 3% (normal conditions) - 5 % (abnormal conditions)

Uranium enrichment: ²³⁵U wt.% 0.5-1.5 %
Plutonium composition: ²⁴⁰Pu wt.% ≥ 17 %

Weapon-grade plutonium

PuO₂ content: 22 % (primary blend)
6.5 % (final blend)

Powder density: 5.5 g/cm³

Water content: 1% - 5%

Uranium enrichment: ^{235}U wt.% 0.5-1.5 %

Plutonium composition ^{240}Pu wt.% ~ 4 %

For these fissile media, the neutron energy spectrum varies between fast and intermediate energies. (Note, additional needs may be identified during the course of the Workshop that could extend or further constrain these parameters.)

The purpose of this session is to identify facilities at which the needed MOX experiments can be performed and to identify the strengths and weaknesses (lack of sufficient fuel and / or equipment, challenges faced to gain regulatory approval, etc.) of each facility. Other resources that can be used to address areas of weakness at candidate experimental facilities should also be identified. Presentations should focus only on the ability to contribute to filling the stated need and should not address other capabilities. Preliminary design of proposed experiments should clearly demonstrate that they meet the specific need (i.e., comparisons of spectra data, neutron balance data, sensitivity data, etc.)

Session 4: Panel Discussion – Prospects for International Co-operative Program

The purpose of the panel discussion is to discuss in an open forum, the information provided in the previous sessions and to reach a consensus among the panellists on the following three questions:

- (1) Is there a real need for additional MOX experiments?
- (2) Which proposal or combination of proposals seems to best fill the need?
- (3) What are the prospects for an International Co-operative Program?

Preliminary program

Wednesday – 14 April 2004, starting at 9:00 am	
Introduction (9:00 – 9:30)	T. Dujardin (NEA)
Session 1: MOX Fuel Fabrication – Design, Industrial Experience and associated Criticality-Safety issues	
	Name
Time	Chairpersons: Yvon Vanderborck (Belgonucléaire, Belgium) Toshihiro Yamamoto (JAERI, Japan)
9:30 – 10:00	M. Arslan, J.P Bariteau, Y. Couty, D.Favet (COGEMA, France): "MELOX plant – MOX manufacturing – Results and prospects".
10:00 – 10:30	H. Libon et al. (Belgonucléaire, Belgium): " Operating a criticality safety management system in a MOX fuel fabrication plant ".
10:30 – 11:00	T. Doering, R. Foster and K. Niemer (AREVA and Duke Energy, USA): " US MOX Fuel Fabrication – Design, Industry Experience, Challenges and associated Criticality-Safety issues ".
Break	
11:30 – 12:00	A. Devita, S. Evo, S. Perrin, V. Rouyer, J-L Voitellier, (COGEMA + IRSN, France): "Criticality Safety issues associated with MOX fuels"
12:00 – 12:30	C. Tripp (NRC, USA): "Licensing issues associated with PuO ₂ and Mixed Oxide Powder Processes"
Lunch	
Session 2: Experimental Data Needs	
	Name
Time	Chairpersons: Mike Westfall (ORNL, USA) / Patrick Cousinou (IRSN, France)
14:00 – 14:30	I. Duhamel, A. Santamarina and V. Rouyer (CEA+IRSN, France): "Criticality calculation code validation: experimental needs for low-moderated MOX media"
14:30 – 15:00	T. Yamamoto (JAERI, Japan): "Research Activities in Japan Atomic Energy Research Institute for criticality safety issue on MOX fuel fabrication process"
15:00 – 15:30	C. Hopper (ORNL, USA): "Links among Available Integral Benchmarks and Differential Data Evaluations, Computational Biases and Uncertainties, and Nuclear Criticality Safety Bases on Potential MOX Production Throughput"
Break	
16:00 – 16:30	A. Tsiboulia (IPPE, Russia): "Experimental Needs for Estimation of Criticality Prediction Accuracy for Systems with MOX Fuel"
16:30 – 17:00	J. Gulliford and J. Edge (BNFL, UK): "Validation for intermediate spectrum MOX applications and estimate of the impact of nuclear data uncertainties on assessment modeling".
17:00 – 17:30	T. Nakata and S. Mitake (JNES, Japan): "Validation Study of Criticality Safety Analysis Codes for Plutonium Fuel Systems".
17:30 – 18:00	B. Lance et al. (Belgonucléaire, Belgium): "Criticality codes validation on spherical plutonium systems"

Thursday – 15 April 2004 starting at 9:00 am	
Session 3: Proposed Programs and Presentation of Experimental Facilities	
	Name
Time	Chairpersons: Pierre D'Hondt (SCK.CEN, Belgium) / Jim Gulliford (BNFL, UK)
9:00 – 9:30	P. Fouillaud (CEA/Valduc, France): "The Criticality laboratory of Valduc (France) and its ability to meet the experimental needs for low moderated « MOX » fissile media"
9:30 – 10:00	I. Matveencko and A. Tsiboulia (IPPE, Russia): "Experiments with MOX fuel planned on the BFS facility"
10:00 – 10:30	P. Baeten et al. (SCK.MOL, Belgium): "Critical Experiments with low-moderated MOX rods in VENUS "
Break	
11:00 – 11:30	P. Van den Hende et al. (Belgonucléaire): "KEOPS : a critical experiment using PuO ₂ powder in the VENUS reactor"
11:30 – 12:00	D. Hayes (LANL, USA): "Mixed Oxide Fuel Experiments and the Los Alamos Critical Experiments Facility"
12:00 – 12:30	P. Blaise et al. (CEA, France): "Integral needs for MOX powders. State of the art at CEA Cadarache on MOX fuel experiments".
Lunch	

Session 4: Panel Discussion – Prospects for International Co-operative Program	
	Name
15:00 – 17:00	Moderator: Blair Briggs (INEEL, USA)
Panel Member 1	Jacques Basselier (Belgonucléaire, Belgium)
Panel Member 2	Jean-Christophe Niel (IRSN, France)
Panel Member 3	Hervé Toubon (COGEMA, France)
Panel Member 4	Toshihiro Yamamoto (JAERI, Japan)
Panel Member 5	Anatoli Tsiboulia (IPPE, Russia)
Panel Member 6	Jim Gulliford, (BNFL, UK)
Panel Member 7	Calvin Hopper (ORNL, USA)
Panel Member 8	Christopher Tripp (NRC, USA)
	Name
17:00 – 17:30 Summary of the workshop	Ali Nouri (NEA)