

INTERNATIONAL ATOMIC ENERGY AGENCY**TECHNICAL MEETING ON FUEL ASSEMBLY STRUCTURAL BEHAVIOUR****22 - 26 November 2004****Cadarache, France****INFORMATION SHEET****I. INTRODUCTION**

To improve the fuel cycle economics, advanced operational strategies, e.g. extended burnup, higher thermal rate, longer fuel cycles, etc, have been introduced by fuel utilities. This places additional requirements on mechanical characteristics of fuel assemblies (FAs) and their components (FA skeleton as a whole, rods, spacer grids, hold down springs, guide tubes, etc). They should withstand to irradiation, high temperatures, mechanical loads and corrosion environment with minimal changes in stiffness characteristics and geometry. Deficiency either in the FA stiffness or in mechanical properties of structural materials (under normal and accident) operating conditions sometimes resulted in very undesirable effects, e.g. FA bow or grid-to-rod fretting.

First observations of FA bow and respectively control rod insertion (IRI) and sticking problems were reported for 17x17 PWR FAs, with few exceptions in long cores with 14 ft active length, and for non-jacketed WWER-1000 FAs in early 90s. Investigations showed that low stiffness of the FA skeleton was a major contributing factor into this phenomenon. Remedies including design changes improving FA stiffness and structural materials with improved mechanical properties were recommended and introduced. Situation with FA bow is not so critical now as it was several years ago, but utilities continue to perform FA shape measurement's programmes, both in core and in a storage pool. These issues first were considered in detail at series of the IAEA Consultants Meetings on "Control Rod Insertion Reliability for WWER-1000 NPPs" in 1995, at the OECD/NEA Specialist Meeting on "Nuclear Fuel and Control Rods: Operating Experience, Design Evolution and Safety Aspects", Madrid, Spain, 5-7 November 1996, then at the Workshop on "PWR and WWER Fuel Assembly Bow", organized by Richard von Jan and Hans G. Weidinger, Rez, Czech Republic, 17-19 February 1998. Amongst other topics, PWR/WWER-1000 FA Bow phenomenon was discussed at the International Topical Meetings on LWR Fuel Performance in 1997 and 2000, Top Fuel Meetings in 1997, 1999 2001 and 2003, and at the International Seminars on "WWER Reactor Fuel Performance, Modelling and Experimental Support" in 1997, 1999, 2001 and 2003.

Grid-to-rod fretting issues appear from time to time in different PWR and WWER plants. Causes are different and very plant specific. Spacer spring breakage, baffle jetting for FAs at core periphery, rod vibration and some others were recognized as damage causes. These cases were presented at the above-mentioned conferences and discussed in detail at the IAEA Technical Meeting on Fuel Failure in Water Reactors: Causes and Mitigation" held in Bratislava, Slovakia in 2002. Additionally to FA stiffness aspects, thermal hydraulics was considered important issue in the analysis of grid-to-rod fretting failures.

Having in mind the need to discuss in depth the structural behaviour of PWR/WWER FAs at high burnup, this Technical Meeting was proposed to the Agency by the Technical Working Group on Water Reactor Fuel Performance and Technology (TWGFPT) at its meeting in May 2001. TWGFPT emphasized the importance of detailed consideration of these phenomena for normal, transient and accident conditions.

II. PURPOSE AND AIM OF THE MEETING

This meeting aims to provide technical exchanges about PWR and WWER operational experience in the field of the fuel assembly mechanical behaviour and the potential impact of the future high burnup fuel managements on the fuel reliability. The issues to be addressed can deal with the in-service experience and remedial solutions, loop testing experience, qualification and damage assessment methods (analytic or experimental ones), mechanical behaviour of the fuel assembly including dynamic and fluid structure interaction aspects, modelling and numerical analysis methods, impact of the in-service evolution of the structural materials. Normal and accidental conditions will be considered.

III. TOPICS TO BE COVERED

Papers are invited on all aspects of fuel assembly mechanical behaviour at high duty operation, e.g. high burnup, increased thermal loads and extended fuel cycles, at normal, transient and accident conditions. Data and reviews on plant experience, experimental and modelling activities relative to the understanding and improvement of fuel assembly mechanical behaviour are welcome. In the conclusions of the above-mentioned earlier and related meetings and the recommendations of the TWGFPT, the following topics were identified as being of particular interest:

- Fuel Assembly Bowing;
- Control Rod Drop (including IRI and kinetics);
- Fuel Assembly Handling and pool storage experience;
- Hydraulic Loadings (pressure drops, lift off and transverse forces...);
- Vibrations and Rod Grid Wear (response to flow turbulence, instabilities, baffle jetting...);
- Accidental Conditions Evaluation and modelling.

IV. ORGANIZATION

Meeting

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V. DEADLINE FOR PAPERS AND PARTICIPATION IN THE MEETING

The meeting may be attended only upon designation. Participants should complete the attached Forms A and B (if applicable) and send them, together with an abstract of approximately 300 words, to the appropriate official authority (Ministry of Foreign Affairs or National Atomic Energy Authority) for subsequent transmission to the IAEA, not later than **27 August 2004**, with a copy to the Scientific Secretary, Mr. Vladimir Onufriev and to the Meeting Coordinator, Mrs. Joëlle Vallory. The abstracts should summarize the content and principal conclusions of the paper.

Prospective participants whose designations have been received by the IAEA will be notified directly. Also, the authors will be notified about the acceptance of their paper(s) and the preliminary programme will be issued by **18 October 2004**. As usually practiced in these types of meetings, the programme will include a panel session to permit participants to prepare the summary and highlights of the meeting and to make recommendations to the IAEA on future work in this field.

Upon arrival to the meeting, the authors are requested to bring:

- One camera-ready copy of the complete presentation, including illustrations in a form suitable for printing. Copy will be used in printing of the proceedings of the meeting;
- Approximately 50 copies of their papers for distribution at the meeting;
- A diskette/CD-ROM with the paper in MS Office Word 2000.

VI. VENUE AND ACCOMMODATION

- Designated participants who require a **visa to enter** France should submit the necessary application form in due time to the nearest diplomatic or consular representative of France.
- All **technical sessions** of the meeting will take place at the CEA Cadarache Castle located next to the CEA/Cadarache centre. The meeting place can be reached by plane (Marseille/Provence airport) or by train (Aix-en-Provence, TGV station). Detailed indications of access will be communicated to the participants together with the final program.
- Each participant is to make his **own hotel reservation**. 40 rooms have been pre-booked at the CEA Cadarache Castle (47 € for a double room and 43 € for a single room) for participants who wish to stay at the meeting place (phone number for booking at the CEA Cadarache Castle: + 33 4 42 25 25 69 and facsimile number: + 33 4 42 25 63 63). It takes about 45 minutes by car to reach the castle in Cadarache Centre from Aix-en-Provence. It is planned to provide a special bus to pick up meeting participants choosing to live in Aix-en-Provence. In addition, a list of hotels at Aix-en-Provence can be found on Internet under http://fr.federal-hotel.com/hotels_aix-en-provence.15686.htm. A list of selected hotels is also attached in Appendix 1.

- On Thursday November 25th, half-day of the meeting will be set aside for a **technical visit** of the nuclear facilities at Cadarache Centre. Details of the arrangements will be made available at the start of the meeting. To register for the visit, interested participants should e-mail to the Meeting Administrator, Mr T. D'Aletto, **not later than 1 October 2004, the following personal information:**
 - **Family name and given name,**
 - **Place and date of birth,**
 - **Citizenship,**
 - **Personal address,**
 - **Passport number, date of issue and final date of validity,**
 - **Employer, function.**

VII. EXPENDITURES

In accordance with the established rules, Governments or other national authorities are expected to bear the travel and other costs of designated participants in the Technical Meeting.

Please note that compensation is not payable by the Agency for any damage to or loss of the experts' personal property. However, for the period of their engagement with the Agency, including travel between their residence and the duty station, the designated experts will be covered under the Agency's insurance policy for, inter alia, permanent total disability or death up to an amount of US\$ 100,000 and for medical expenses up to an amount of US \$10,000 in case of illness, injury or death attributable to their relationship with the Agency, subject to the terms of the insurance policy.

VIII. WORKING LANGUAGE

The working language of the meeting will be English. All communications, abstracts, and papers must be sent in English.

FORM A
T1-TM-26475



INTERNATIONAL ATOMIC ENERGY AGENCY

Technical Meeting on Fuel Assembly Structural Behaviour
22 - 26 November 2004
Cadarache, France

To be sent to competent official authority (Ministry of Foreign Affairs, National Atomic Energy Authority) for transmission to the International Atomic Energy Agency, Vienna International Centre, Wagramer Strasse 5, P.O. Box 100, A-1400 Vienna, Austria

PARTICIPATION FORM

DEADLINE FOR APPLICATION: 27 August 2004

Family name:	All initials of given name:	Mr. Ms.
Institution:	Full address:	
	For urgent communications please indicate: Phone No.: Telefax No.: E-mail:	
Nationality:	Designating government or organization:	
Mailing address (if different from address of institution):		
Date of departure from mailing address:		

Do you intend to present a paper?	YES <input type="checkbox"/>	NO <input type="checkbox"/>
Title	of	Paper
.....		
.....		
An abstract of my paper is attached?	YES <input type="checkbox"/>	NO <input type="checkbox"/>

FORM B
T1-TM-26475



INTERNATIONAL ATOMIC ENERGY AGENCY
Technical Meeting on Fuel Assembly Structural Behaviour
22 - 26 November 2004
Cadarache, France

FORM FOR SUBMISSION OF A PAPER

DEADLINE FOR APPLICATION: 27 August 2004

TITLE OF THE PAPER		
AUTHOR(S) INITIAL(S) AND FAMILY NAME(S)	SCIENTIFIC ESTABLISHMENT(S) IN WHICH WORK HAS BEEN CARRIED OUT	TOWN/COUNTRY
1.		
2.		
3.		
4.		
AUTHOR WHO WILL PRESENT THE PAPER		Mailing Address:
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I HEREBY AGREE TO ASSIGN TO THE INTERNATIONAL ATOMIC ENERGY AGENCY <input type="checkbox"/> THE COPYRIGHT OR <input type="checkbox"/> THE NON-EXCLUSIVE, ROYALTY FREE LICENSE TO PUBLISH THE ABOVE-MENTIONED PAPER, AND CERTIFY THAT NO OTHER RIGHTS HAVE BEEN GRANTED WHICH COULD CONFLICT WITH THE RIGHT HEREBY GIVEN TO THE AGENCY. DATE: (SIGNATURE OF MAIN AUTHOR)		

APPENDIX 1

Selection of hotels located at AIX-en-PROVENCE (downtown)

HOTEL	ADDRESS	TEL +33 (0)4	FAX +33 (0)4 E-MAIL	TARIFF
***GRAND HOTEL NEGRE COSTE	3 cours Mirabeau 13100 Aix-en-Pce	42 27 74 22	42 26 80 93	Double room : ~ 65 €
***LES AUGUSTINS	3 rue de la Masse 13100 Aix-en-Pce	42 27 28 59	42 26 74 87 info@hotel-augustins.com	Standard room & lower season 95 €
***LE MANOIR	8 rue Entrecasteaux 13100 Aix-en-Pce	42 26 27 20	42 27 17 97 info@hotel-le-manoir.com	double room : ~ 60 €
***SAINT CHRISTOPHE	2 avenue Victor Hugo 13100 Aix-en-Pce	42 26 01 24	42 38 53 17 saintchristophe@france-market.com	Double room : ~ 70 €
**LE MOZART	49 cours Gambetta 13100 Aix-en-Pce	42 21 62 86 42 96 99 80	42 96 17 36	Double room : ~ 57 €
**CARDINAL	24 cardinal 13100 Aix-en-Pce	42 38 32 30	42 26 39 05	Double room : ~ 58 €
**ARTEA	4 boulevard République 13100 Aix-en-Pce	42 27 36 00	42 27 28 76 area-hotel@wanadoo.fr	Single room : ~ 60 € Double room : ~ 66 € lower season

* lower season (November)