IAEA
International Atomic Energy Agency
Atoms for Peace and Development

Technical Meeting on Safety and Performance Aspects in the Development and Qualification of High Burnup Nuclear Fuels for Water-Cooled Reactors

IAEA Headquarters
Vienna, Austria

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Information Sheet

Introduction

An increasing maturity of nuclear technology and progress in knowledge of nuclear fuel behaviour, through operational experience (OPEX) of commercial nuclear power plants (NPP), supported by experiments and numerical modelling and simulation, have driven efforts by the nuclear industry worldwide towards an increase in the discharge burnup of nuclear fuel in Water-Cooled Reactors (WCR).

The current operating limit slightly varies among licensee organizations, but in many Member States it corresponds to a rod average burnup of 62 gigawatt-day/tons of uranium (GWd/tU) (average fuel sub-assembly of 55 GWd/tU), or other equivalent criteria. Nuclear fuel vendors and NPP operators continue extending the discharge burnup of nuclear fuel assemblies within the operating envelope accepted by national regulators. Nuclear fuel vendors and NPP operators might obtain economic benefits from such high burnup operation via, for example, longer reactor cycle operation, as well as decreases in purchases, transport and handling of fewer fuel assemblies for the core reloading.

Currently, increased rates of fuel discharge burnup (e.g., beyond 62 GWd/tU) are also being pursued by Member States in the framework of the development of advanced technology for nuclear fuel (which include so-called Accident Tolerant Fuels or Advanced Technology Fuels), particularly in association with

advanced fuel and cladding materials, which might require higher fissile enrichment rates (in some cases exceeding 5%) in order to counterbalance increased parasitic neutron absorption in the cladding. Some nuclear fuel vendors and NPP operators are even exploring the possibility of increasing the operating envelope up to 80 GWd/tU, which would imply the need to address considerable technical challenges, such as:

- Improvement of nuclear fuel analytical codes for the accurate prediction of fuel behaviour and performance at higher burnups;
- Update of source term calculations;
- Modifications for higher heat loads in the spent fuel pool;
- Performance of design and safety analyses at higher burnups addressing potentially new phenomena, including Fuel Fragmentation Relocation and Dispersal (FFRD);
- Possible degradation of safety performance in normal operation and in accident conditions, posing considerable challenges for the development and qualification of high burnup nuclear fuels.

Objectives

The objective of the event is to provide a platform for Member States to exchange information on safety and performance of high burnup nuclear fuels for WCR, considering their development, qualification and licensing.

The event will focus on operational experience of, and margins assessment by, licensee organizations, experience of fuel developers in the development and qualification of fuel designs and irradiation of 'lead test' or 'lead use' fuel rods beyond 62 GWd/tU, experimental testing in research reactors and associated modelling and simulation, validation and application of computer codes and methods for fuel design and safety analysis, and practices by national regulators and technical support organizations in development or adaptation of licensing frameworks for high burnup nuclear fuels.

Target Audience

The event is targeted at professionals from nuclear fuel or reactor design organizations, licensee organizations, national regulators, technical support organizations and research organizations with specialized knowledge of, or experience in, nuclear fuel development, qualification and licensing, or any other activity related to high burnup nuclear fuel safety and performance.

Working Language(s)

English.

Expected Outputs

Participants will share knowledge and experiences in safety and performance-related aspects in the development, qualification and licensing of high burn-up nuclear fuels for WCR.

The material presented during the event, along with the results of the technical discussions, will provide valuable input for the development of a technical document on the same topic and will also aim at identifying opportunities for enhanced international cooperation in the field.

Topics

The scope of this Technical Meeting will encompass design, qualification, licensing, and in-reactor operation of UO_2-Zr-based alloys (including doped-UO_2 and coated cladding), with discharge burnup exceeding 62 GWd/tU (fuel rod average) or 55 GWd/tU (fuel assembly average), or other equivalent criteria.

The event is intended to cover the following topics:

- Licensee organisations' operational experience and margins assessment at high burnup;
- Experience of fuel developers in development and qualification of fuel designs for high burnup, including advanced fuel and cladding designs, irradiation of test fuel rods beyond 62 GWd/tU, pool-site inspections and post-irradiation examinations;
- Experimental testing (in-pile and out-of-pile) and associated multiphysics and multiscale modelling and simulation of fuels at high burnup, with focus on:
    - High burnup phenomena characterization, including micro-structure, rim, FFRD, enhanced fission gas release, source term, etc.;
    - Thermo-physical, thermo-mechanical properties, corrosion, hydrogen pick-up;
    - National and international programs for integral safety testing (loss of coolant accident, reactivity insertion accident).
- Adequacy of safety design criteria at high burnup;
- Validation and application of computer codes and methods for design and safety analysis for high burnup fuels;
- Practices by national regulators and technical support organizations in development or adaptation of licensing frameworks for nuclear fuels to address specific safety features of high burnup nuclear fuels, with focus on regulatory expectations from qualification process, and opportunities for harmonization of national licensing approaches;
- Industry experience in performing economic assessments of expected benefits of increased burnup rates.

Participation and Registration

All persons wishing to participate in the event have to be designated by an IAEA Member State or should be members of organizations that have been invited to attend.

In order to be designated by an IAEA Member State, participants are requested to send the **Participation Form (Form A)** to their competent national authority (e.g. Ministry of Foreign Affairs, Permanent Mission to the IAEA or National Atomic Energy Authority) for onward transmission to the IAEA by **14 September 2022**. Participants who are members of an organization invited to attend are requested to send the **Participation Form (Form A)** through their organization to the IAEA by the above deadline.

Selected participants will be informed in due course on the procedures to be followed with regard to administrative and financial matters.

Papers and Presentations

The IAEA encourages participants to give presentations on the work of their respective institutions that falls under the topics listed above.

Participants who wish to give presentations are requested to submit an abstract of their work. The abstract will be reviewed as part of the selection process for presentations. The abstract should be in A4 page format, should extend to no more than 2 pages (including figures and tables) and should not exceed 500 words. It should be sent electronically to Mr Simone Massara, the Scientific Secretary of the event (see contact details below), not later than **14 September 2022**. Authors will be notified of the acceptance of their proposed presentations by **4 October 2022**.

In addition, participants have to submit the abstract together with the **Participation Form (Form A)** and the attached **Form for Submission of a Paper (Form B)** to their competent national authority (e.g. Ministry of Foreign Affairs, Permanent Mission to the IAEA or National Atomic Energy Authority) or their organization for onward transmission to the IAEA not later than **14 September 2022.**

Expenditures and Grants

No registration fee is charged to participants.

The IAEA is generally not in a position to bear the travel and other costs of participants in the event. The IAEA has, however, limited funds at its disposal to help meet the cost of attendance of certain participants. Upon specific request, such assistance may be offered to normally one participant per country, provided that, in the IAEA's view, the participant will make an important contribution to the event.

The application for financial support should be made using the **Grant Application Form (Form C),** which has to be stamped, signed and submitted by the competent national authority to the IAEA together with the **Participation Form (Form A)** by **14 September 2022**.

Venue

The event will be held at the Vienna International Centre (VIC), where the IAEA's Headquarters are located. Participants must make their own travel and accommodation arrangements.

General information on the VIC and other practical details, such as a list of hotels offering a reduced rate for IAEA participants, are listed on the following IAEA web page:

www.iaea.org/events.

Participants are advised to arrive at Checkpoint 1/Gate 1 of the VIC one hour before the start of the event on the first day in order to allow for timely registration. Participants will need to present an official photo identification document in order to be admitted to the VIC premises.

Visas

Participants who require a visa to enter Austria should submit the necessary application to the nearest diplomatic or consular representative of Austria at least four weeks before they travel to Austria. Since Austria is a Schengen State, persons requiring a visa will have to apply for a Schengen visa. In States where Austria has no diplomatic mission, visas can be obtained from the consular authority of a Schengen Partner State representing Austria in the country in question.

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Subsequent correspondence on scientific matters should be sent to the Scientific Secretary/Secretaries and correspondence on other matters related to the event to the Administrative Secretary.