IAEA
International Atomic Energy Agency
Atoms for Peace and Development

Workshop on Core and Plant Simulation with an Emphasis on Fuel Behaviour in Light Water Reactor Based Small Modular Reactors

IAEA Headquarters, Vienna, Austria
and virtual participation via Cisco Webex

27 - 29 February 2024

Ref. No.: EVT2304645

Information Sheet

Introduction

To meet the growing demand for energy and to mitigate global climate challenge, the use of Small Modular Reactors (SMRs) has raised an increasing interest in Member States, especially for regions inaccessible to large electricity grids or requiring technology options deployed incrementally. SMRs are also viable options for users that need more than just a supply of electricity, e.g., district heating, desalination, industrial process heat, as well as hydrogen.

SMR development is a topic of high interest in MSs' nuclear R&D activities, and significant progress has been made in many countries, including in innovative fuel design for SMRs. R&D is underway on UO_2 fuels and ATFs for light-water-cooled SMRs (e.g., CAREM, SMART, BWRX-300, NuScale, NUWARD^{TM}, Rolls-Royce SMR, SMR-160, LUTHER, LDR-50, and mPower). However, the new small core design, the integral concept, the innovative heat exchangers, and passive heat removal systems as well as the novel containment designs represent new challenges for the safety demonstration in the frame of licensing processes. The design peculiarities of SMR-cores, along with the potential use of enhanced accident tolerant fuel materials, are challenging the prediction capability and accuracy of currently used analysis tools.

The IAEA Technical Working Group on Fuel Performance and Technology (TWG-FPT) during its 21st meeting, in April 2023, recommended to organize a Workshop on LWR SMR fuel behaviour simulation, jointly with the Euratom project McSAFER, to compare the results of SMR fuel behaviour simulation

using common analysis tools, taking advantage of the fact that the McSAFER project is ending and its results already available.

The aim of the Euratom Horizon 2020's project McSAFER (High-Performance Advanced Methods and Experimental Investigations for the Safety Evaluation of Generic Small Modular Reactors) was to advance the safety research for water-cooled SMRs, with:

a) Key experiments relevant to SMR safety (e.g., heat transfer, boiling, critical heat flux (CHF) and cross-flow in the core, system behaviour under natural and forced convection, and heat transfer and pressure drop in helical heat exchanges) performed at EU facilities (e.g., COSMOS-H, MOTEL and HWAT);
b) The development, improvement, and validation of simulation tools (thermal-hydraulics codes, neutronics codes and fuel performance codes) for safety evaluations of SMRs; and
c) The application of simulation tools to four SMR designs (i.e., NUWARD™ , CAREM, NuScale and SMART).

The IAEA is therefore organizing a joint workshop with the EU McSAFER Project and the support of the US Oak-Ridge National Laboratory (ORNL), to foster the exchange of information on approaches, challenges and specific experiences related to multi-physics and multi-scale simulations of SMR-cores.

Objectives

The purpose of the event is to bring together experts in the field of fuel behaviour simulation, to foster the exchange of information on multi-physics and multi-scale simulations of SMR-cores (loaded with ATF fuels or without) and integral plant behaviour, using different computation approaches, to compare results of SMR fuel behaviour simulation and to perform common analyses.

Target Audience

The event is intended for participants from research organizations, nuclear fuel design organizations, nuclear power plants and regulatory bodies, technical support organizations, universities, and other organizations engaged in fuel behaviour simulation of SMR-cores, and in SMR nuclear fuel design, as appropriate.

Working Language(s)

English

Expected Outputs

The event will provide the basis for an IAEA publication on multi-physics core and fuel behaviour simulation in Light Water Reactor Based Small Modular Reactors.

Structure and topics

The programme will mainly consist of sessions dedicated to invited oral talks and discussions. A Programme Committee made up of international representatives will be responsible for selecting the invited oral presentations and for arranging the technical and discussion sessions, as well as their scientific content. The topical area of focus will be the current situation in MSs in multi-physics and multi-scale simulations of the SMR-cores (loaded with ATF-fuels or without) and integral plant behaviour using different computational approaches.

This event will comprise 3 main technical sessions as follows:

- Multi-physics analysis of SMR-cores with different simulation approaches (includes neutronic and thermal hydraulics) applied to cores loaded **with ATFs** or without **(e.g., nodal and pin level solutions)**
    - Traditional approach
    - Industrial approach
    - Emerging approaches (e.g., neutron diffusion solvers coupled with subchannel solvers for nodal level core analysis, Monte Carlo codes coupled with subchannel codes for pin/subchannel level simulations).
- Multi-physics analysis of SMR-cores with different simulation approaches (includes neutronic and thermal hydraulics and **thermo-mechanics**) applied to cores loaded **with ATFs** or without:
    - Traditional approach
    - Industrial approach
    - Emerging approaches (e.g., neutron diffusion solvers coupled with subchannel and thermo-mechanic solvers for nodal level core analysis, Monte Carlo codes coupled with subchannel codes and thermo-mechanic solvers for pin/subchannel level simulations).
- Transient analysis of water-cooled SMRs with different computational approaches:
    - Traditional approach using 1D thermal hydraulics and 3D nodal diffusion core solvers
    - Industrial approaches
    - Emerging approaches (e.g., multiscale coupling of thermal hydraulic system codes coupled with subchannel codes and 3d nodal diffusion, and thermal hydraulic system codes coupled with CFD codes and 3D nodal diffusion).

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 or invited organization, participants are requested to submit their application via the InTouch+ platform (https://intouchplus.iaea.org) to the competent national authority (Ministry of Foreign Affairs, Permanent Mission to the IAEA or National Atomic Energy Authority) or organization for onward transmission to the IAEA by **8 January 2024**, following the registration procedure in InTouch+:

1. Access the InTouch+ platform (https://intouchplus.iaea.org):
    - Persons with an existing NUCLEUS account can sign in to the platform with their username and password;
    - Persons without an existing NUCLEUS account can register here.

2. Once signed in, prospective participants can use the InTouch+ platform to:

- Complete or update their personal details under 'Complete Profile' and upload the relevant supporting documents;
- Search for the relevant event under the 'My Eligible Events' tab;
- Select the Member State or invited organization they want to represent from the drop-down menu entitled 'Designating Authority' (if an invited organization is not listed, please contact InTouchPlus.Contact-Point@iaea.org);
- If applicable, indicate whether financial support is requested and complete the relevant information (this is not applicable to participants from invited organizations);
- Based on the data input, the InTouch+ platform will automatically generate the Participation Form (Form A) and/or the Grant Application Form (Form C);
- Submit their application.

Once submitted through the InTouch+ platform, the application, together with the auto-generated form(s), will be transmitted automatically to the required authority for approval. If approved, the application, together with the applicable form(s), will automatically be sent to the IAEA through the online platform.

NOTE: The application for financial support should be made, together with the submission of the application, by **8 January 2024.**

For additional information on how to apply for an event, please refer to the InTouch+ Help page. Any other issues or queries related to InTouch+ can be sent to InTouchPlus.Contact-Point@iaea.org.

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

Participants are hereby informed that the personal data they submit will be processed in line with the Agency's Personal Data and Privacy Policy and is collected solely for the purpose(s) of reviewing and assessing the application and to complete logistical arrangements where required. The IAEA may also use the contact details of Applicants to inform them of the IAEA's scientific and technical publications, or the latest employment opportunities and current open vacancies at the IAEA. These secondary purposes are consistent with the IAEA's mandate. Further information can be found in the Data Processing Notice concerning IAEA InTouch+ platform.

Papers and Presentations

The IAEA encourages participants to give presentations on the work of their respective institutions that falls under the topics listed above. Approximately 30 minutes will be allotted for each presentation, including floor discussion.

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. The abstract should be in A4 page format, should be **more than one page and no more than three pages**. It should be sent electronically to **Ms Anzhelika Khaperskaia**, the Scientific Secretary of the event (see contact details below), not later than **8 January 2024**. Authors will be notified of the acceptance of their proposed presentations by **20 January 2024**

In addition to the registration already submitted through the InTouch+ platform, participants have to submit the abstract, together with the Form for Submission of a Paper (Form B), to the competent national authority (e.g. Ministry of Foreign Affairs, Permanent Mission to the IAEA or National Atomic Energy Authority) or organization for onward transmission to the IAEA not later than **8 January 2024**.

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, together with the submission of the application, by **8 January 2024**.

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.

Additional Information

Programme Committee

The International Programme Advisory Committee is composed of the following members:

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V.H. Sanchez-Espinoza, (Chair)	Germany, KIT, Coordinator McSAFER
S. Kliem	Germany, HZDR, McSAFER
C. Queral	Spain, UPM, McSAFER
P. Van Uffelen	Germany, European Commission (DG JRC), McSAFER
M. Bencik,	Czech Republic, UJV, McSAFER
H. Suikkanen	Finland, LUT, McSAFER
A. Iorizzo	Belgium, European Commission (DG RTD) Project Officer for McSAFER
N. Capps	United States of America, ORNL
M. Ševeček	Czech Republic, CTUP
V. Valtavirta	Finland, VTT

IAEA Contacts

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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.

Event Web Page

Please visit the following IAEA web page regularly for new information regarding this event:

www.iaea.org/events/ EVT2304645

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Form B

EVT2304645

Form for Submission of a Paper

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To be completed by the participant and sent to the competent national authority (e.g. Ministry of Foreign Affairs, Permanent Mission to the IAEA, or National Atomic Energy Authority) of his/her country for subsequent transmission to the International Atomic Energy Agency (IAEA) either by email to: Official.Mail@iaea.org or by fax to: +43 1 26007 (no hard copies needed). Please also send a copy by email to the Scientific Secretary (A.Khaperskaia@iaea.org) and to the Administrative Secretary (J.Golubovic@iaea.org).

Participants who are members of an invited organization can submit this form to their organization for subsequent transmission to the IAEA.

Deadline for receipt by IAEA through official channels as per Conference Announcement.

Title of the paper:		
If applicable: Abstract ID in IAEA-INDICO:		
Family name(s) and first name(s) of all author(s): e.g. Smith, John	Scientific establishment(s) in which the work has been carried out	City/Country
1.		
2.		
3.		
Family name and first name(s) of author presenting the paper: e.g. Smith, John	Mr/Ms:	
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Date: **Signature of main author:**