

Fifth OECD/NEA Rostov-2 VVER-1000 multi-physics transient benchmark workshop (Rostov2-5)

**Bologna, Italy
May 26, 2023 (track 1)**

Hosted by ENEA, Italy

Announcement and Proposed Program

Background and Purpose of 5th Rostov-2 Benchmark Meeting

The fifth OECD/NEA Rostov-2 VVER-1000 multi-physics transient benchmark workshop (Rostov2-5) will be held on May 26, 2023, in Bologna, Italy and is a follow up to the previous workshops. The Rostov2-5 meeting will be held in conjunction with other OECD/NEA Working Party on scientific issues and uncertainty of Reactor Systems (WPRS) meetings/workshops to facilitate co-ordination and sharing of work. Nine other meetings are being held in two parallel tracks at Bologna, Italy during the same week in order to combine efforts in common areas such as neutronics, thermal-hydraulics, and multi-physics modelling and uncertainty analysis and to make the participation more efficient. The meetings/workshops concerned are:

- May 22, 2023 (track 2 morning) – Ninth COBRA-TF (CTF) User’s Group (UG) Meeting (CTF-9) followed by a hands-on CTF training sessions which will be conducted on Monday afternoon, May 22, 2023 and Tuesday morning, May 23, 2023 (track 2);
- May 22, 2023 (track 1 afternoon) – First Burst-Fission-Gas Release Benchmark (BFGR-1) workshop;
- May 23, 2023 (track 1) - Sixteen OECD/NEA Light Water Reactor (LWR) Uncertainty Analysis in Modelling (UAM) Benchmark (LWR-UAM-16) workshop;
- May 23, 2023 (track 2) – OECD/NEA HTGR-TH Benchmark introductory presentation and discussions;
- May 22-23 (track 3), 2023 – OECD/NEA International School on Simulation of Nuclear Reactor Systems (SINUS);
- May 24, 2023 (track 1 morning) - OECD/NEA Task Force on Doppler Effective Fuel Temperature meeting;
- May 24, 2023 (track 2 morning) – Fourth OECD/NEA McMaster Core Thermal-Hydraulics (CTH) Benchmark (CTH-4) workshop;
- May 24, 2023 (track 1 afternoon) – OECD/NEA Task Force Artificial Intelligence & Machine Learning meeting;
- May 24, 2023 (track 2 afternoon – LFR neutronics) – May 25, 2023 (track 2 morning – LFR Thermal-hydraulics) – Second OECD/NEA Lead Fast Reactor (LFR) Benchmark (LFR-2) workshop;
- May 24, 2023 (track 1 afternoon) – May 25, 2023 (track 1 morning) - Eight OECD/NEA Time-Dependent Neutron Transport (C5G7-TD) Benchmark (C5G7-TD-8) workshop;
- May 25, 2023 (track 2 afternoon) – Second Liquid Metal Fast Reactor (LMFR) Thermal-Hydraulics (T/H) Benchmark workshop (LMFR T/H-2);
- May 25, 2023 (track 1 afternoon) – May 26, 2023 (track 1 morning) - Third meeting on OECD/NEA TVA Watts Bar 1 (WB1) Multi-Physics Multi-Cycle Depletion Benchmark (TVA-WB1-3) workshop.
- May 26, 2023 (track 2) - Eight OECD/NEA Sodium Fast Reactor (SFR) UAM Benchmark workshop (SFR-UAM-8);

The Rostov-2 benchmark is based on recent measurements of VVER-1000 transient behavior from tests with a multitude of well-documented neutron-physics and thermal-hydraulics data that have been performed at Rostov Unit 2 (Rostov-2) Nuclear Power Plant (NPP). The reactor type is VVER-1000 with fuel assemblies type TBC-2M, which enable an 18-month fuel cycle length. Integral (plant) data and local (core) measured data were collected during the test, which are used for the validation of both traditional and novel multi-physics codes. The measurement and recording of parameters was performed by the standard means available at NPP and by a special

system of experimental control. The difference in comparison with all previous OECD/NEA benchmarks for coupled code validation is the introduction of high fidelity multi-physics simulation codes that could predict pin-by-pin power distributions in the reactor core as well as flow mixing in the primary loop, in the reactor pressure vessel including its active core part. For the OECD/NEA Rostov-2 VVER-1000 multi-physics benchmark the reference problem chosen for simulation and comparison with the measured data is based on a test characterized by the “Reactivity compensation with diluted boron by stepwise insertion of control rod cluster into the VVER core”. The selected benchmark transient allows performing simulation tests with different levels of modeling fidelity and complexity.

The general frame of the OECD/NEA Rostov-2 benchmark consists of two phases with different exercises for each phase:

Phase I - Assembly-wise (traditional) analysis:

Exercise I.1 – Thermal-Hydraulic (T-H) plant simulation using power tables

Exercise I.2 – Coupled Three-Dimensional (3-D) neutronics/core T-H response evaluation

Exercise I.2a – Hot Zero Power (HZP) state

Exercise I.2b – 75% Hot Power (HP) state

Exercise I.3 – Best-estimate coupled code plant transient modelling

Phase 2 - Full core pin-by-pin (novel) analysis:

Exercise 2.1 – Boundary condition steady-state problem

Exercise 2.2 – Boundary condition transient calculations

Exercise 2.3 – Best-estimate coupled pin-by-pin transient calculations

Benchmark Specification has been updated to Version 1.8 by the benchmark team to be discussed at the incoming first benchmark workshop along with remaining missing information and needed clarifications.

The information about the Rostov-2 benchmark is provided at:

https://www.oecd-nea.org/jcms/pl_32189/rostov-2-vver-1000-benchmark

Scope and Technical Content of the Meeting

The topics to be addressed at the workshop include:

– Review and discussion of the updated specifications including templates for submitting participants’ results,

– Present updated support data and cross-section libraries,

– Present updated experimental and measured data,

– Discuss missing information and needed clarifications,

– Present and discuss benchmark team support and related studies,

– Participants’ presentations on their modelling and results for the two benchmark Phases,

Presentations on other related activities in multi-physics validation of VVERs,
Defining a work plan and schedule for Rostov-2 activities.

The proposed meeting program is attached as Annex 1.

Organization of the Meeting

The meeting is organized around the discussion of the Rostov-2 benchmark specifications, preliminary results, participants' questions, and benchmark-related activities. The participants are requested to present their expertise and experience in benchmark-related modeling, verification and validation, uncertainty quantification/propagation and applications.

Participation in the Meeting Participation is restricted to individuals from OECD/NEA member country institutions who agree to the benchmark non-disclosure agreement (NDA). Participants are asked to sign and send the corresponding NDA form to wprs@oecd-nea.org.

Rostov-2 benchmark conditions to release form can be found at:

https://www.oecd-nea.org/upload/docs/application/pdf/2021-02/rostov-2_conditions_for_release.pdf

Organization and Program Committee of the Meeting

An Organization and Program Committee has been nominated to make the necessary arrangements for the Rostov2-4 meeting and to draw up the final program, etc.

The members of the Program Committee are:

Giacomo Grasso – Co-Chair, and Local Host
ENEA, Italy

Maria Avramova - *Co-Chair*
North Carolina State University, USA

Kostadin Ivanov
North Carolina State University, USA

Elena Poplavskaia
OECD/Nuclear Energy Agency, France

Secretariat: **Oliver Buss**
OECD/Nuclear Energy Agency, France

Proposed Program of the Meeting

The proposed program was drawn up by the Program Committee and is enclosed as Annex 1.

Language of the Benchmark Workshop

The official language of the Rostov2-5 meeting is English.

Proceedings of the Meeting

A summary of the Rostov2-5 meeting will be published by the program committee after the meeting. The summary will be distributed free of charge to the participants in the meeting. The presentations will be available free of charge to the participants to download from participants' restricted area after the Rostov2-5 meeting.

Contacts and Registrations

The annual benchmark workshops/meetings of the [Working Party on Scientific Issues and Uncertainty Analysis of Reactor Systems \(WPRS\)](#) including the Rostov2-4 meeting will be hosted by ENEA in Bologna, Italy. The meetings will take place in three parallel tracks during the week of May 22-26, 2023 to exchange results and lessons learned for the different WPRS benchmark activities and to discuss future activities.

The link to registration page for the WPRS-related workshops/meetings (including Rostov2-4), overall program, and local information for transportation and hotels is:

https://www.oecd-nea.org/jcms/pl_71612/wprs-benchmarks-workshop-2023

The link to registration page for the CTF-9 UG Meeting and Training is:

<https://www.ne.ncsu.edu/rdfmg/cobra-tf/ninth-ctf-user-group-ug-meeting-and-training>

Workshop Location

The meeting place for the ten meetings/workshops during the week of May 22 – 26, 2023, in three tracks is at the Zanol Hotel Europa, Bologna, Italy (in-person meeting). As mentioned above the local information for transportation and hotels is given at:

https://www.oecd-nea.org/jcms/pl_71612/wprs-benchmarks-workshop-2023

The program and schedule of the meetings is shown below:

	Track 1	Track 2	Track 3
Monday, May 22	Morning: MPCMIV Afternoon: Burst Fission Gas Release	Morning: CTF UG Afternoon: CTF Training	Morning: SINUS Afternoon: SINUS
Tuesday, May 23	Morning: LWR UAM Afternoon: LWR UAM	Morning: HTGR-TH Afternoon: HTGR-TH	Morning: SINUS Afternoon: CTF Training
Wednesday, May 24	Morning: Task Force on Doppler Effective Fuel Temperature Afternoon: Task Force on AI & ML	Morning: McMaster CTH Afternoon: LFR Neutronics	
Thursday, May 25	Morning: C5G7-TD Afternoon: TVA-WB1	Morning: LFR TH Afternoon: LMFR TH	
Friday, May 26	Morning: TVA-WB1 Afternoon: Rostov-2	Morning: SFR-UAM Afternoon: SFR-UAM	

ANNEX 1

OECD/NEA Rostov-2 VVER-1000 Multi-Physics Transient Benchmark - Fifth Workshop (Rostov2-5)

Host Organization

Hosted by ENEA

Bologna, Italy

May 26, 2023 (Track 1)

PROPOSED PROGRAM

R01-10: Session code

May 26, 2023 (Track 1)

- R01. Introduction and opening remarks.
- R02. Overview and status of benchmark activities.
- R03. Discussion of the updated Specifications and templates for submitting participants' results.
- R04. Presentation of updated experimental and measured data.
- R05. Presentation of updated support data and cross-section libraries.
- R06. Discussion of missing information and needed clarifications in the benchmark specifications.
- R07. Presentation and discussion of preliminary, and support studies.
- R08. Presentations of reference analyses.
- R09. Participants' presentations on their modelling and results for the exercises of Phases I and II of the Rostov-2 benchmark.
- R10. Participants' presentations on their modelling and results of VVER-1000 multi-physics transient calculations.
- R11. Action items and schedule of benchmark activities - next workshop and plans.
- R12. Conclusions and closing remarks.