IAEA
International Atomic Energy Agency
Atoms for Peace and Development

Interregional Training Course on Advances in High Temperature Gas-cooled Reactor Type Small Modular Reactors and their Analytical Tools

Hosted by

The Government of Germany

Through the

Technical University of Munich

3 - 7 November 2025

Munich, Germany

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Information Sheet

Purpose

The purpose of the event is to train the participants on high temperature gas cooled reactors (HTGR) focusing on the status of current technologies, reactor design concepts, reactor physics, core thermal fluid design, safety analyses, and their tools for modelling and simulation.

Working Language

The working language of the event will be English.

Deadline for Nominations

Nominations received after **3 August 2025** will not be considered.

Background Information

To meet the growing demand for energy and to mitigate global climate change challenge, the interest in Small Modular Reactors (SMRs) and Micro-Reactors (MRs) is growing, especially in regions inaccessible to large electricity grids and regions with smaller electricity grids that need technology options deployed incrementally to closely match increasing energy demand. SMRs and MRs are also viable options for users with needs beyond electricity supply, e.g., district heating, desalination, and industrial process heat, as well as hydrogen. The purpose of the project is to provide broad support to Member States in the development and deployment of SMRs and MRs. The project provides a broad range of fora to enable effective capacity building through training and technology transfer activities on all aspects of SMR development. The project also covers the emerging MRs, the development of SMRs for electric and non-electric applications, and the coupling of such nuclear systems with renewables in integrated energy systems. The aim of the project is to enable national stakeholders to gain enhanced understanding of key characteristics of SMR and MR technologies and their applications, and to formulate, in line with international safety standards, countries' specific legal and regulatory frameworks, and generic user requirements and criteria for SMR technologies.

Nuclear power is broadly recognized as a low-carbon energy source and is a key option to achieve zero-carbon economies by 2050, as outlined in the 2015 Paris Climate Agreement, provided that it can be deployed quickly and on a large scale. SMRs have the potential to become game changers thanks to their mass production in factories, small footprint, and compatibility with smaller grids, making them an attractive option for a broad range of users across the globe.

For SMRs to be massively deployed by 2050, they need to become mature solutions and reach some kind of standardization. This makes the supply chain a crucial element in the deployment of SMRs. Use of standards and codes for SMR may support this standardization, as will design engineering. The testing of components may also support harmonization of regulatory practices by sharing standardized testing methodologies.

This training course is a part of the interregional project INT/2/023 which is supporting Member States' capacity building on small modular reactors and micro-reactors and their technology and applications as a contribution of nuclear power to the mitigation of climate change.

This interregional training course aims to provide a comprehensive understanding of the global status of developments in regard to HTGR technology, the design concepts based on pebble bed and prismatic cores, reactor physics, and simulation tools.

The main focus of the training course is on computational modelling tools, particularly the HTR Code Package (known as the HCP code) and STACY code. The HCP code allows for the simulation of several safety-related aspects of an HTGR core in a highly integrated manner. The code system STACY is used for HTGR safety analyses for the quantification of fission product release from the fuel both during normal operation and under the conditions of various accident scenarios. These codes were initially developed by Research Centre Jülich, Germany and currently developed in Technical University of Munich and Becker Technologies, Germany. Older versions (executable versions), as transferred from Research Centre Jülich, Germany to the IAEA, are available by request through the IAEA Open-source Nuclear Codes for Reactor Analysis (ONCORE) platform.

Through dedicated theoretical and practical sessions, the training course will equip the participants with the fundamental skills to perform design optimization and safety analyses of HTGRs.

Scope and Nature

This training course will consist of theoretical sessions to cover:

- Global overview of the HTGR design developments for SMRs including microreactors

- General aspects of high temperature gas cooled reactor technology
- Physical aspects of core layout
- Thermos-hydraulic aspects of the reactor core
- Fuel elements
- Reactor components
- Safety aspects and analysis of accidents
- Fundamentals, HCP framework, modules (version available on IAEA ONCORE) and current development status of the HCP in Technical University of Munich
- Overview of STACY code and its integration into HCP code

as well as practical session focused on:

- Demonstration of reactor design using the HCP
- Design optimization and safety analysis with the HCP
- Modelling fission product release using STACY code
- Case studies and practical exercises

In addition, the event will provide opportunities for participants to network and continue sharing information and good practices on using the modelling codes in their work. The participants will benefit directly from the experience of the developers of the codes and will have the opportunity to gain a deep understanding in the assumptions and boundary conditions used.

References:
The following IAEA publications provide relevant information to Member States:

- International Atomic Energy Agency, Decay heat removal and heat transfer under normal and accident conditions in gas cooled reactors, IAEA-TECDOC-757 (1994)
- International Atomic Energy Agency, Design and Development of Gas Cooled Reactors with Closed Cycle Gas Turbines, IAEA TECDOC 899 (1996)
- International Atomic Energy Agency, Fuel Performance and Fission Product Behaviour in Gas Cooled Reactors, IAEA TECDOC 978 (1997)
- International Atomic Energy Agency, High Temperature Gas Cooled Reactor Technology Development, IAEA TECDOC 988 (1998)
- International Atomic Energy Agency, Evaluation of High Temperature Gas Cooled Reactor Performance: Benchmark Analysis Related to Initial Testing of the HTTR and HTR 10, IAEA TECDOC 1382 (2003)
- International Atomic Energy Agency, Evaluation of High Temperature Gas Cooled Reactor Performance: Benchmark Analysis Related to the PBMR 400, PBMM, GT MHR, HTR 10 and the ASTRA Critical Facility, IAEA TECDOC 1694 (2013)
- International Atomic Energy Agency, Small Modular Reactor Technology Catalogue 2024, A Supplement to the non-serial publication: Small Modular Reactors: Advances in Developments 2024
- International Atomic Energy Agency, Advances in Small Modular Reactor Technology Developments, A Supplement to: IAEA Advanced Reactors Information System (ARIS), 2022 Edition
- The IAEA Advanced Reactor Information System (ARIS), https://aris.iaea.org/

Expected Outputs

The expected output of the training course consists of the following:

- Detailed technical presentations and course materials that support the training sessions
- Enhanced understanding on the global developments and reactor physics of high temperature gas cooled reactor technology
- Enhanced capability to use the HCP and STACY codes, with illustration of case studies to support safety analysis

- Establishment of a user group for the codes with the support of developers

Participation

The event is open to up to 25 participants from the following Member States participating in the TC Project INT/2/023:

The selected participants to attend from the following member states will be funded through INT2/0/23:

- Algeria, Argentina, China, Ethiopia, Ghana, Indonesia, Jordan, Kenya, Kuwait, Malaysia, Mongolia, Morocco, Myanmar, Nigeria, Pakistan, Philippines, Poland, Singapore, South Africa, Sri Lanka, Thailand, Tunisia, Türkiye, Ukraine, United Republic of Tanzania, and Uzbekistan

At no cost to the IAEA, the participants from following countries can also be considered:

- Canada, France, Japan, Republic of Korea, Russian Federation, United Kingdom, and United States of America

Participants' Qualification and Experience

The training course is designed for doctoral students and professionals interested in HTGR technology development and modelling for safety analysis, in particular reactor physicists, nuclear engineering graduates, nuclear regulators. A background in nuclear engineering is a prerequisite to attending the training course, and familiarity with HTGR modelling codes is an asset.

Candidates who previously attended this similar course will not be accepted to participate more than once to give the opportunity for new candidates to gain the knowledge of the course. This will enhance the capacity building of multiple staff in the organization.

Application Procedure

Candidates wishing to apply for this event should follow the steps below:

1. Access the InTouch+ home page (https://intouchplus.iaea.org) using the candidate's existing Nucleus username and password. If the candidate is not a registered Nucleus user, she/he must create a Nucleus account (https://websso.iaea.org/IM/UserRegistrationPage.aspx) before proceeding with the event application process below.
2. On the InTouch + platform, the candidate must:
   a) Finalize or update her/his personal details, provide sufficient information to establish the required qualifications regarding education, language skills and work experience ('Profile' tab) and upload relevant supporting documents;
   b) Search for the relevant technical cooperation event (**EVT2500479**) under the 'My Eligible Events' tab, answer the mandatory questions and lastly submit the application to the required authority.

NOTE: Completed applications need to be approved by the relevant national authority, i.e. the National Liaison Office, and submitted to the IAEA through the established official channels by the

provided designation deadline. **All nominations must include a scan of the candidate's first page of passport with photo.**

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

Should online application submission not be possible, candidates may download the nomination form for the training course from the IAEA website.

NOTE: A medical certificate signed by a registered medical practitioner dated not more than four months prior to starting date of the event must be submitted by candidates when applying for a) events with a duration exceeding one month, and/or b) all candidates over the age of 65 regardless of the event duration.

Administrative and Financial Arrangements

Nominating authorities will be informed in due course of the names of the candidates who have been selected and will at that time be informed of the procedure to be followed with regard to administrative and financial matters.

Selected participants will receive an allowance from the IAEA sufficient to cover their costs of lodging, daily subsistence, and miscellaneous expenses. They will also receive either a round-trip air ticket based on the most direct and economical route between the airport nearest their residence and the airport nearest the duty station through the IAEA's travel agency American Express, or a travel grant, or they will be reimbursed travel by car/bus/train in accordance with IAEA rules for non-staff travel.

Disclaimer of Liability

The organizers of the event do not accept liability for the payment of any cost or compensation that may arise from damage to or loss of personal property, or from illness, injury, disability or death of a participant while she/he is travelling to and from or attending the course, and it is clearly understood that each Government, in approving her/his participation, undertakes responsibility for such coverage. Governments would be well advised to take out insurance against these risks.

Note for female participants

Any woman engaged by the IAEA for work or training should notify the IAEA on becoming aware that she is pregnant.

The Board of Governors of the IAEA approved new International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources. The Standards deal specifically with the occupational exposure conditions of female workers by requiring, inter alia, that a female worker should, on becoming aware that she is pregnant, notify her employer in order that her working conditions may be modified, if necessary. This notification shall not be considered a reason to exclude her from work; however, her working conditions, with respect to occupational exposure shall be adapted with a view to ensuring that her embryo or foetus be afforded the same broad level of protection as required for members of the public.

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