McSAFER

IMPROVING SAFETY ANALYSIS METHODOLOGIES AND MOVING FROM TRADITIONAL TO HIGH-FIDELITY SAFETY ANALYSIS TOOLS FOR SMALL MODULAR REACTORS

ABOUT THE PROJECT

Interest in the development and deployment of Small Modular Reactors (SMR) has increased in the last years in Europe and worldwide. SMRs have a great potential for safe, flexible and CO2-free power generation, salt water desalination, and process heat generation. They are currently considered in various countries as an alternative to large nuclear power plants and as part of the future energy-mix to achieve the low-carbon power generation goals with low risk and cost in a competitive energy market. 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 a licensing process. The design peculiarities of SMR-cores, along with the potential use of enhanced accident tolerant fuel materials (EAFT), are challenging the prediction capability and accuracy of legacy analysis tools. Instead, the use of multi-dimensional numerical tools and novel approaches is needed. The validation of these numerical simulation tools is of paramount importance for the acceptability and use by regulators, industry, and policy makers within a licensing process.

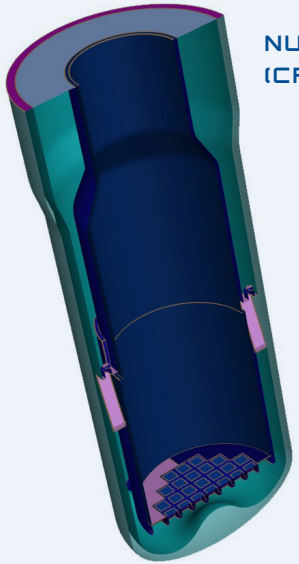
AIM AND OBJECTIVES

The aim of the McSAFER project is to advance the safety research for SMRs by combining safety-relevant thermal hydraulic experiments and numerical simulations of different approaches for safety evaluations.

The neutron physical, thermal hydraulics and safety related investigations are focused on four SMR-designs: CAREM, SMART, FSMR and NuSale. In McSAFER, researchers and industrial partners will perform experiments on existing European thermal hydraulic test facilities such as COSMOS-H (KIT), HWAT (KTH), and MOTEL (LUT). The goal is to develop and improve simulation tools for SMRs and to validate the applied simulation tools with the experimental data generated within McSAFER. The simulation tools will then be applied to the four selected SMR-designs with consideration of EAFT materials in one design. The outcome of the tests and simulations will contribute a valuable step to demonstrate the advantages of high-fidelity codes in practical licensing processes.

AMBITION

- Increase the level of knowledge about thermal hydraulic phenomena in SMR-concepts to support the licensing process of SMRs in Europe.
- Improve low order deterministic neutronic solvers for the pin/subchannel level simulation of reactor cores and further develop multiscale thermal hydraulic solvers for the more precise simulation to support the safety evaluations of SMR-cores.
- Consolidate the application of high-fidelity tools based on multi-scale and multi-physics for the evaluation of the safety of SMR-designs.



NUSCALE VESSEL
(CFD FIGURE)

PARTNER

The McSAFER consortium consists of 13 partners including universities, research centres, manufacturers, and utilities located in Europe and Latin America.

Karlsruher Institut für Technologie (KIT)
Germany

Lappeenrannan-Lahden teknillinen yliopisto LUT (LUT)
Finland

Commissariat à l'énergie atomique et aux énergies alternatives (CEA)
France

ÚJV Řež, a. s. (UJV)
Czechia

Helmholtz-Zentrum Dresden-Rossendorf EV (HZDR)
Germany

Jacobs
United Kingdom

Teknologian tutkimuskeskus VTT Oy (VTT)
Finland

Joint Research Centre (JRC)
Belgium

Preussen Elektra GmbH (PEL)
Germany

Universidad Politécnica de Madrid (UPM)
Spain

Tractebel Engineering (TBL)
Belgium

Kungliga Tekniska högskolan (KTH)
Sweden

Comisión Nacional de Energía Atómica (CNEA)
Argentina

The project has received funding from the Horizon 2020 Euratom Research and Training Programme 2019-2020 under the topic "Support for safety research of Small Modular Reactors (NFRP-2019-2020-05)". The project started on 1st September 2020 and will last 36 months. It is coordinated by Dr. V. H. Sanchez Espinoza from the Karlsruhe Institute of Technology (KIT), Institute of Neutron Physics and Reactor Technology (INR).

CONTACT INFORMATION

COORDINATION

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PROJECT START	PROJECT END	EC FUNDING
1st September 2020	31st August 2023 (36 months)	4.045.133,75 €

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