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NURETH-17

Call for Papers

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NURETH-17 Special Topic

Integral Experimental and Analytical Evidence of Controlling Design Basis Accidents Solely Using Passive Safety Systems

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Reactor technology has been developed and improved for more than five decades. Advanced NPP designs are now ready to solve the future energy supply shortfall problem. There are currently two different approaches for the reinforcement of the safety features of NPP. The first one is to retrofit NPPs with new safety systems. This results in more complex NPPs with increased investment costs for maintenance and periodic inspections and jeopardizes their competiveness. The second approach, which is pursued for advanced light water reactors is to reduce system complexity by introducing passive safety systems (PSS). This technological breakthrough is highly innovative. PSSs make use of basic laws of nature (e.g. gravity, free convection, boiling and condensation). These laws enable PSS to function without electrical power supply and actuation by instrumentation and control (I&C) or by operators. By combining these PSSs with proven active safety systems (ASSs), these new designs can be considered to be amongst the safest equipment ever made taking into account important lessons learnt from the Fukushima event and the EU Stress Tests. Gen III+ reactors utilise a passive safety concept (PSC), that means DBA can even be solely controlled by PSS. PSC provides passive protection of the core without external intervention for a duration of several days and afterwards, infinitely with simple measures.

The operation modes of PSSs largely are implying low pressure, they are coming along with new physical phenomena and they require the identification and closure of modelling gaps of the current design and evidence tools. One example for these activities is the German national research alliance *Integral Experimental and Analytical Evidence of Controlling Design Basis Accidents Solely Using Passive Safety SYstems (EASY).* The reference design for EASY is the KERENA reactor, a mid-power Gen III+ boiling water reactor concept developed by AREVA. The Integral Test Facility Karlstein (INKA) was built in large scale and under reactor typical initial and boundary conditions to investigate both the different passive safety systems of KERENA and their mutual interactions. The data will be used for the improvement and validation of the thermal-hydraulic code ATHLET and the containment code COCOSYS.

Topics include, but are not limited to:

- requirements of analytical and experimental proofs
- experiments with original geometries / materials with reactor typical and beyond design initial / boundary conditions, the latter for avoiding cliff-edge effects,
- component tests and integral tests, the latter for understanding of PSSs' mutual interactions,
- understanding and description of all relevant physical phenomena,
- calculations of the experiments with at least one code,
- provision of experimental and analytical sensitivities and uncertainties,
- comparison of experimental and analytical results, (plausibility) comparison with other experiments and / or calculations.